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ABSTRACT

The impact of NCHEMS (National Center for Higher Education Management Systems) products upon planning and management tasks is examined in this study performed at a sample of 126 institutions. The institutions have used one or more of the following NCHEMS products: Program Classification of Structure (PCS); Resource Requirements Prediction Model 1.6 (RRPM); Information Exchange Procedures (IEP); Costing and Data Management Systems (CADMS); and Academic Unit Planning Model (AUPM). Some of the primary concerns in assessing the impact of the five products were: which collegiate institutions have used any of the five products? Why did these institutions use a product(s)? Who within the institutions uses the products? What dissemination factors were most important in selecting the product(s)? For what purposes and activities are the products used? The investigated current practice in using computer-based planning tools was intended to provide policy-relevant, practical information to NCHEMS and to the National Institute of Education to assist them in reviewing one aspect of the accomplishments of NCHEMS and establishing future research directions. It was concluded that the NCHEMS dissemination strategy reconciled normative and descriptive theory for educational institutions through combining the basic research and dissemination activities of the Center. It was affirmed that the NCHEMS dissemination strategy primarily focuses upon disseminating concepts and that products are tools for disseminating concepts. The findings are intended to benefit current and potential users of NCHEMS products and the Postsecondary Education Research Community. An extensive list of figures, tables and bibliographical appendices are provided. (LC)

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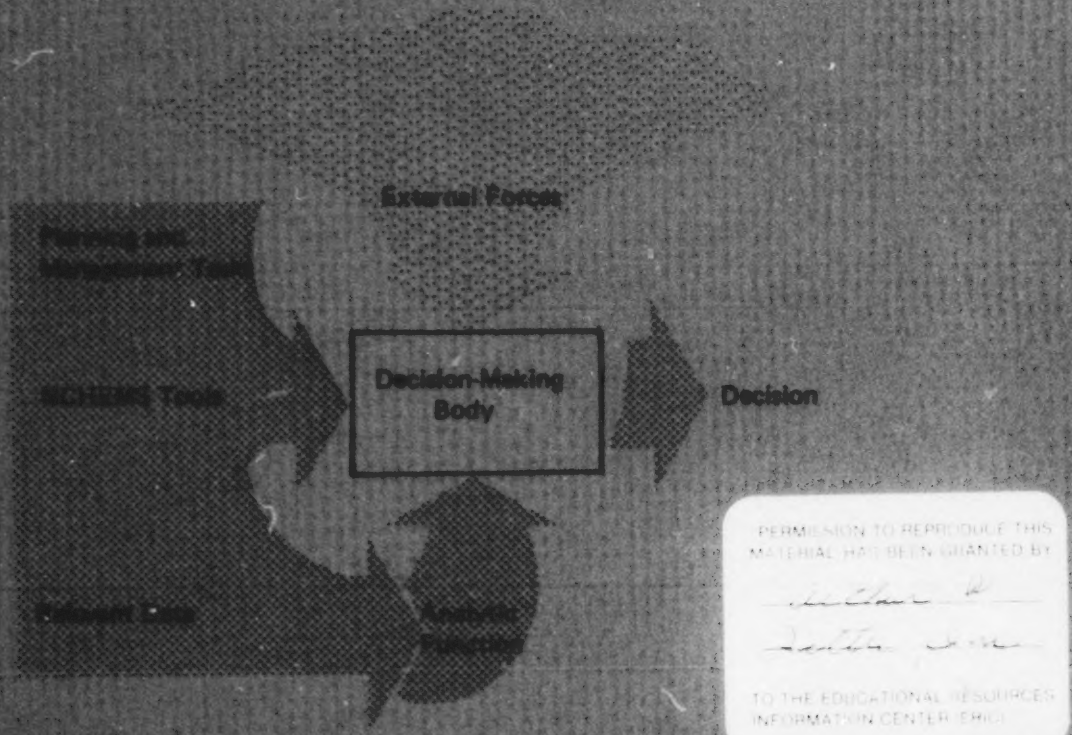
A STUDY OF THE IMPACTS OF SELECTED PRODUCTS DEVELOPED BY THE NATIONAL CENTER FOR HIGHER EDUCATION MANAGEMENT SYSTEMS



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AND

OPINION RESEARCH CORPORATION
PRINCETON, NEW JERSEY

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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I. EXECUTIVE SUMMARY

A. INTRODUCTION

This study was performed by Arthur D. Little, Inc., of Cambridge, Massachusetts, and its subsidiary, Opinion Research Corporation of Princeton, New Jersey, for the National Center for Higher Education Management Systems (NCHEMS) and the National Institute of Education (NIE).

For purposes of this study, we have accepted the stated mission of NCHEMS as a basis for developing our research design:

> "The general mission of the National Center for Higher Education Management Systems (NCHEMS) is to carry out research, development, dissemination, and evaluation activities and to serve as a national resource to assist individuals, institutions, agencies, and organizations of postsecondary education as well as state and federal agencies in bringing about improvements in planning and management in postsecondary education." (NCHEMS Articles of Incorporation, 1977)

During the period of this study, the NCHEMS strategy to realize its mission emphasized quantitative approaches to improve the management of postsecondary education. The concepts of quantitative approaches to management include:

- Definition of the problem;
- Understanding inter-relationships of external factors;
- Understanding inter-relationships of internal units and dynamics of the organizations; and
- Generation of alternatives for consideration by decision-makers.

NCHEMS recognizes that different strategies may be appropriate for different periods of the Center's development. In the past NCHEMS activities have focused on such areas as "information standards" and "analytic tools and techniques." NCHEMS strategies for realizing its mission are adaptive to these changing environments.

The objectives of this study are delimited to the five products selected for evaluation. It has not been our intent to conduct an encompassing evaluation of how well, or effectively, NCHEMS is achieving its mission. However, we have used the above mission definition in developing the research design presented below.

B. OBJECTIVE OF STUDY

The objective of this study was to examine how certain planning and management tasks are performed at a sample of 126 institutions, representative of the approximately 800 collegiate-sector institutions which have used one or more of the NCHEMS products included in this study.

This product-impact study included five NCHEMS products:

- Academic Unit Planning Model (AUPM);
- Costing and Data Management System (CADMS);
- Information Exchange Procedures (IEP);
- Program Classification Structure (PCS); and
- Resource Requirements Prediction Model 1.6 (RRPM 1.6).

The five products were selected by NCHEMS staff, in consultation with NIE staff, based upon two criteria:

- Represented a sample of institutional products developed by NCHEMS; and
- Disseminated for a sufficient length of time (3-5 years) that their impacts could be evaluated.

All the above products are designed to meet institutional-wide planning and management functions, with one exception. AUPM is intended to assist academic unit managers.

The intended audiences for this study include:

- The NCHEMS Board of Directors;
- The NCHEMS Staff;
- The National Institute of Education (a major funding agency for the research developments undertaken by NCHEMS);
- Current and potential users of NCHEMS products; and
- The Postsecondary Education Research Community.

In this study we investigated current practice in using computer-based planning tools and, based upon the experience gained from this practice, projected future needs. The requirements for the study were to provide policy-relevant, practical, useful information to NCHEMS and to the National Institute of Education to assist them in reviewing one aspect of the accomplishments of NCHEMS (product development, training, and technical assistance) and establishing future research directions.

Some of the primary concerns in assessing the impact of the five products were:

- Which collegiate institutions have ever used one or more of the five products included in this study?
- Why did these institutions elect to use a product(s)?
- Who within user-institutions uses the products?
- What dissemination factors were most important in the institution's decision to use the product(s)?
- For what purposes and activities are the products used?

- What benefits can be attributed to the use of the products?
- What environmental, organizational, and individual factors affect the use and/or benefits derived from the products?

These and related concerns were investigated in the study.

C. RESEARCH DESIGN

The research methodology developed to fulfill the above objectives for this study consisted of the following elements:

- Conceptual framework;
- Sampling plan;
- Interview and data collection plan; and
- Analysis plan.

How should one assess the impact of NCHEMS products? Should it be on the basis of the use of the *products* themselves, or upon an understanding by the users of the *concepts* incorporated in the products? We believe that NCHEMS research, development, dissemination, and evaluation activities should be evaluated based upon both: 1) an understanding of the concepts incorporated in the products; and 2) the number of products in use. This dual evaluation approach is based upon the hypothesis that the products are tools used to disseminate knowledge about the improvements of management of postsecondary education.

The *conceptual framework* was designed to accommodate this above dual assessment perspective:

- Product use — five-stage dissemination strategy; and awareness
- Concept — analytical approaches to management.

The *conceptual framework for product use* includes five stages:

- Awareness;
- Interest;
- Evaluation;
- Trial;
- Adoption.

The conceptual framework for product use was developed from the work of Rogers and others who have studied diffusion and innovation.

The *conceptual framework for concept awareness* is presented in Figure I-1. It was adapted from those who have studied the human thought processes as they apply to decision problems. We investigated the assumptions of the analytic approaches to management in which a complete cycle of organizational choice is assumed and as modified by other assumptions of organizational behavior. The conceptual framework (adapted from Hammond; March and Olsen; Schultz and Slevin; and Rodgers) draws upon currently accepted organizational theory and practice. We emphasized accepted

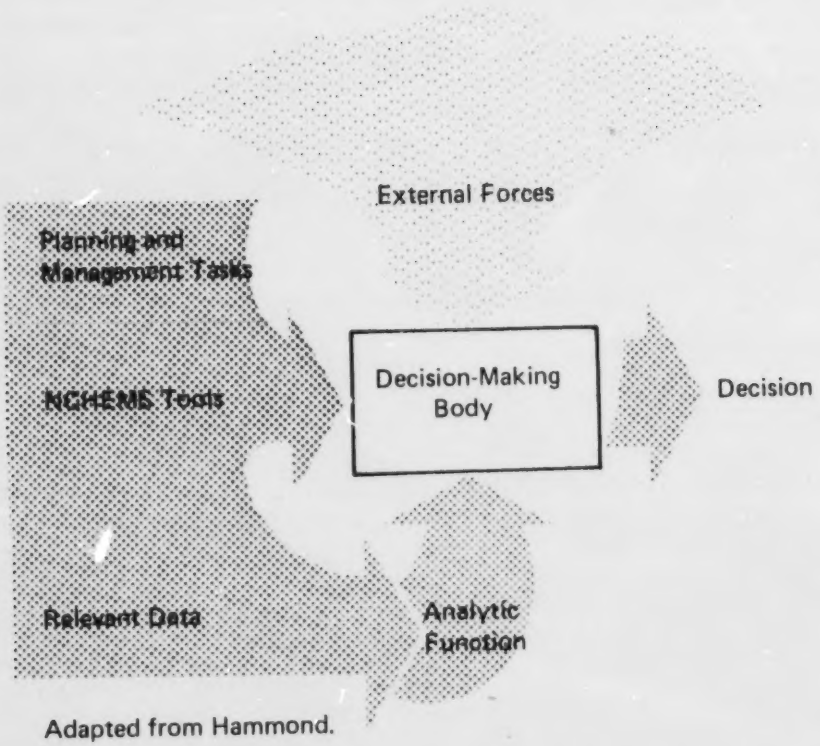


FIGURE I – 1 PRELIMINARY CONCEPTUAL FRAMEWORK

FIGURE I-1 PRELIMINARY CONCEPTUAL FRAMEWORK

management science and organizational theory related to educational institutions. A taxonomy was developed to describe planning and management functions, and to differentiate between strategic planning processes and management control processes. This conceptual framework has served as a guide to the design of this study, and has provided the structure for analyzing the data and reporting the results of this research.

The *sampling plan* is based upon a two-phase approach. First, we conducted a screening survey of the person in charge of the analytic function at approximately 1500 institutions and branches to determine their awareness of NCHEMS products, their use of NCHEMS and other analytical tools, and their awareness of the concepts incorporated in NCHEMS products. This screening survey permitted: 1) an accurate identification of the institutions that had ever used one or more of the five NCHEMS products included in the study; and 2) a generalization of the findings of Phase I to the entire collegiate sector. Second, based upon the results of this screening survey, we then developed a sampling plan of 372 identified NCHEMS user-institutions which are representative of the entire NCHEMS user population of collegiate-sector institutions.

We also conducted our *interviewing and data collection plan* in two phases. In both phases we used a pre-coded questionnaire format. Pre-coded questions were prepared by the senior staff of Arthur D. Little, Inc., to investigate the following issues deemed to be relevant to the objectives of this study. Both Phase I and Phase II *data collection* activities were conducted using personal interviewing — Phase I being a telephone survey, and Phase II being conducted through on-site personal interviewing in which we utilized the executive interviewing field staff of the Opinion Research Corporation. Through personal interviewing, we were able to explore, in greater detail, the responses to certain questions which would not have been available had we used a mail survey. The limitations of personal interviewing as a method of data collection are also reviewed in Chapter II.

We conducted our *analysis plan* utilizing the results of the interviews. Each of the precoded questions were analyzed with respect to the independent variables identified as important for the study. These independent variables included:

- Organizational context of the respondent (institutional, academic management, or analytic function);
- Type and control of the institution (2-year College, 4-year College, University; Public and Private);
- Governance pattern of the institution (individually governed institutions; or governed by a multi-campus or system governing board);
- Enrollment size;
- Analytic function assigned to a manager with other line responsibilities or an analytic staff;
- Beliefs with respect to the role of professional management in education;

- Effectiveness of the planning process (a ranked score based on specified dimensions used to assess the planning processes of an institution);
- Quality of data available for decision-making;
- Use of computer-based tools (ranging from using no computer-based tools; using NCHEMS tools either exclusively or in combination with other tools; or using other computer-based planning tools than those developed by NCHEMS);
- NCHEMS product use combinations; and
- Geographical areas (Phase I only).

We tabulated the results of each question according to the independent variables cited above. Statistical significance was determined at the 95% confidence level.

In addition, we developed definitions with respect to:

- A taxonomy of planning and management tasks of postsecondary educational institutions;
- Sectors of postsecondary educational institutions;
- Position levels of management; and
- Taxonomy of coordinating/governing boards.

Each of these definitions is delineated in Chapter II of the full report.

D. WHO USES NCHEMS PRODUCTS/CONCEPTS?

In Chapter III, we review who currently uses NCHEMS products and their associated concepts. These findings are summarized below.

1) Product Use

Approximately 55% of the 3,075 collegiate-sector institutions and branches have utilized one or more computer-based planning tools at some time, and some 26% of these collegiate-sector institutions and branches have utilized one or more of the NCHEMS products included in this study. We found that organizational complexity, approximated by enrollment size, tends to have the greatest influence on the propensity of an institution to use computer-based planning tools. In terms of type and control, public sector universities and four-year institutions have a greater propensity to use NCHEMS tools than other sectors. There is a notable underrepresentation of NCHEMS users in two-year public and private institutions and private universities and four-year institutions, which collectively comprise more than three-fourths of the collegiate sector institutions. From another perspective, institutions with enrollments of less than 2,000 students tend to make less use of NCHEMS tools than institutions with more than 2,000 students. Furthermore, institutions with more than 20,000 students tend to utilize tools other than those of NCHEMS, most of these developed by themselves rather than acquired from sources external to the institution.

In the Phase I screening survey, we found that about 50% of the administrators in charge of the analytic function of collegiate sector institutions were *aware* of each of the NCHEMS products in this study, with the exception of AUPM where only 39% were aware of that particular product. We also found that in institutions which utilize NCHEMS products, the administrators tended to be more aware of the other NCHEMS products included in this study than the analytic function person at institutions which do not use NCHEMS tools.

Interest in computer-based planning tools tends to be influenced by some factors supported by NCHEMS dissemination strategy more than others. Manuals (including user and technical), papers and presentations written and delivered by the NCHEMS staff and/or members of the advisory structure representing NCHEMS, and NCHEMS training and dissemination seminars all tend to be more influential sources of information about NCHEMS products than other elements of the dissemination strategy.

We found that professional associations influence the thinking of their membership with respect to the use of computer-based tools; and this linkage structure is utilized by NCHEMS as a network for informing potential users about NCHEMS tools and concepts.

2) Concept Awareness

Now let us turn to concepts incorporated in NCHEMS products. We found that, in practice, there is an acceptance of the quantitative approaches to management identified above. However, we also found that other factors external to the decision-making bodies affect the policy formation of institutions included in this study, processes by which alternatives are combined to select a single course of action. These external factors were ranked more influential than the information derived from quantitative tools.

We identified (adapted from March and Olsen) cycles of organizational choice, and found that the cycle of organizational choice is influenced by factors both internal and external to the institution. First we will review the factors of influence that are internal to an institution; then we will review those external to an institution. The two most important factors internal to the institution are the intuitive judgment of the chief executive officer and the interpretation of raw data. The next level of influence is internal staff analysis and recommendations of the faculty. A lower level of internal influence is assigned to collective bargaining agents and information derived from quantitative tools, such as NCHEMS products. Two other factors were ranked as influential — the political pressures of external constituents (i.e., governing boards, alumni, etc.) and the influence of funding agencies, including foundations and state and federal agencies.

3) Contextual Influences on Product/Concept Use

Others who have investigated the use of quantitative tools in decision-making have found that communications between the person in charge of the analytic function and decision-makers is a key influence on the degree to which quantitative tools are

used in decision-making (Schultz and Slevin; Cox *et al.*). We asked respondents to indicate which of a variety of factors they believed inhibited the use of NCHEMS products in their institutions. The most frequently mentioned inhibitor they cited was the decision-makers' need for more training so that they could better use such tools in their work. Other factors mentioned by approximately 40% of the respondents included:

- A conflict between the decision-makers' needs to make timely decisions and the analysts' needs to gather all the relevant data and perform all necessary analyses;
- Incompatible expectations of decision-makers and analysts about the purposes and results of the NCHEMS products used; and
- A lack of clearly defined and understood roles of the decision-makers and analysts in their respective institutions.

This pattern of inhibiting forces differs slightly from that expected, based upon the research summarized by Schultz and Slevin concerning the implementation of operations research techniques. The higher influence of the need for training signals a need with respect to NCHEMS activities — the need to broaden training activities in the use of NCHEMS tools to provide institutionally individualized training programs for the administrators in an institution who will be responsible for using the tools.

Another major factor external to the decision-making body which has been found to influence the use of quantitative tools is the administrator's philosophy with respect to the role of the professional manager in educational institutions. Respondents were asked to assess their perception of the increased role of the professional manager in American higher education, and the degree to which they agreed or disagreed with three statements. First, we found that there was strong concurrence that a personal understanding and an experience in the educational environment were essential for the successful application of management science tools and techniques to postsecondary education problems. Likewise, we found that there was a strong disagreement that such tools could be applied to postsecondary education problems without direct reference to the educational environment. In addition, 71% of those respondents indicated that they believed that academic and institutional managers should have significant academic careers before being appointed administrators. This finding suggests that NCHEMS should emphasize that its staff must have an understanding of the academic environment as well as a knowledge of the application of quantitative tools.

Three independent variables were selected to investigate the influence of the use of the results of quantitative tools (such as NCHEMS) in decision-making. These three independent variables are:

- Quality of data available for decision-making;
- Managerial philosophy of decision-making regarding the use of quantitative tools; and
- Effectiveness of the institution's planning processes.

Based upon the questions used to assess each of the above three independent variables, a high, medium, and low score was constructed from the responses received to the precoded questions. A high scoring on effectiveness of planning was found to be more influential than either of the other two (quality of data available or managerial philosophy).

In addition to investigating the effectiveness of planning, we asked the Phase II respondents to characterize one of their major decision-making processes, viz., budgeting. Some 73% indicated that their budgets could be characterized as line-item budgets, and 56% indicated they would characterize their budgets as planning budgets. On the other hand, 36% indicated that their budgets were prepared in accordance with performance or formula criteria, while only 15% indicated they utilized zero-based budgeting techniques. In addition, 70% indicated that political negotiations influenced their institutions' budgets to great or some extent. About one-half said their budgets were prepared under centralized assumptions, while 43% said their budgets were prepared under decentralized decision-making processes.

Some 92% of the respondents of NCHEMS users felt that they were able to manage scarce resources successfully to either "great" or "some" extent. Those respondents with low scores with respect to effective planning and the quality of data available for decision-making believed that they were less able to manage scarce resources than those with higher scores for effective planning and quality of data for decision-making.

E. PATTERNS OF EVALUATION, TRIAL, AND ADOPTION OF NCHEMS PRODUCTS

We reviewed in detail the elements of NCHEMS dissemination strategy related to patterns of institutional behavior to evaluate NCHEMS products, to conduct trial implementations, and to adopt or reject the products for their specific institutional uses. We also investigated the form of product use, including:

- tried as offered;
- tried with institutional modifications;
- adopted (either as offered or with modifications); or
- rejected.

In addition, we attempted to ascertain the relative influence of five attributes of the NCHEMS products which appear to be important with respect to facilitating product use:

- Initial cost;
- Maintenance cost;
- Flexibility;
- Availability of NCHEMS staff for technical assistance; and
- Sophistication of algorithms.

Each of these issues has important implications for the formation of NCHEMS dissemination strategy.

The small number of cases of previous or current users statistically precluded analysis with tests of significance with respect to the conclusions of this aspect of our review of the dissemination strategy. In evaluating the use of the NCHEMS products included in this study, respondents mentioned the importance of sophistication of algorithms and availability of NCHEMS staff more frequently than initial costs, maintenance costs, and flexibility. After evaluation, the per cent of NCHEMS user institutions which proceeded to try a particular product ranged from 6% for AUPM to 49% for PCS. For those institutions which tried a product, there was less of a tendency to discontinue using a product than in previous steps of the dissemination process. However, there are some patterns which appear important with respect to NCHEMS' dissemination strategy. In each of these three steps of the dissemination strategy — evaluation, trial, and adoption — institutions appear to place equal importance on either using the products as offered by NCHEMS or using the products with institutional modifications.

For those institutions which are not currently utilizing NCHEMS tools, it appears that they began using the products between 1970 and 1975 and discontinued their use between 1975 and 1977. For those institutions which had adopted the products, we asked why they may have discontinued a product's use. The small number of cases precluded any definitive conclusion. About a third of those institutions which had discounted the use of IEP, PCS and RRPM indicated that one of the reasons for discontinuing was that the task for which the product was designed was completed, and this would seem to signal a successful implementation. None of the other respondents indicated a response which would indicate a successful implementation. Therefore, we have to conclude that those who discontinued using NCHEMS products considered the project unsuccessful.

Now let us consider the experience of those institutions which are currently utilizing one or more of the NCHEMS products included in this study. Through the successive steps of trial, adoption, and current use, approximately one-half of the current users stated that they utilized the tools as offered by NCHEMS, and the other half stated that they had made institutional modifications.

Of those institutions which are currently utilizing NCHEMS tools, many considered developing their own models or approaches rather than choosing NCHEMS products. The most important factors which appear to have affected their decisions included staff qualifications; how long it would take to complete the project; and costs. Most of the institutions began utilizing NCHEMS products prior to 1977. In the case of RRPM, a fifth started in 1977.

F. WHO USES THE MODELS, WHY, HOW, AND WITH WHAT BENEFITS?

1. The Users

It is important within the context of a product-impact study to understand who uses the models, why they use them, how the models are used, and what benefits are derived. Each of these questions was investigated in our study. Analytic function

personnel report that they and their staff are more likely to use NCHEMS products in executing their job responsibilities than are institutional and academic unit management personnel. However, again from the perspective of the analytic function personnel, about one-half or more of institutional management personnel use the products. Only in the case of CADMS is a sizable proportion of academic management personnel reported to use the product.

2. How and Why Used

Important reasons for an institution's use of the five products investigated in this study included:

- External funding/governance requirement;
- Need for forecasting abilities;
- Need for analysis of historical trends;
- Need for integration of institutional data;
- Better data required to react to external queries (mainly associated with CADMS);
- Better data required to allocate increasingly scarce resources; and
- Improved design of information systems to meet needs of decision-makers.

For those institutions which utilized the products because of external funding/governance requirements, the two most important external sources cited were statewide coordinating/governing boards and legislative branches of state governments.

Recognizing that the products are used in a variety of ways in each institution, we asked the analytic function personnel to indicate how the products were used in their institution. Most frequently selected uses included:

- to prepare internal reports;
- to prepare reports for external agencies;
- to conduct staff analyses; and
- to develop data bases of the institution.

These issues related to how the products are used. Next let us turn to how the products are used within the context of the planning and management functions of an institution.

We developed a taxonomy of planning and management functions which differentiates between strategic planning and management control processes. They can be categorized according to six functions:

- Strategic Planning Process
  - — Constitutional/statutory/authority decisions;
  - — Strategic planning

- Management Control Process
  - — Resource acquisition
  - — Resource allocation
  - — Institutional and management control
  - — Evaluating/reporting/analysis.

We asked the decision-makers to indicate which products had been utilized for each of the six planning and management functions and the degree to which these products were relevant to that particular function within their respective institutions. The most extensive use of NCHEMS products was for evaluation/reporting and analysis. The next most popular use was for resource allocation, followed equally by strategic planning and institutional management and control. About half of the decision-makers indicated that they had used these products in resource acquisition, while only one-third indicated that they had used the products in making constitutional and statutory authority decisions. Based upon this use pattern, 70% indicated that the products were relevant either to "great" or "some extent" for evaluation/reporting/analysis and resource allocation; 66% indicated the same for strategic planning and institutional management and control; while 58% agreed to the relevance of the products used for resource acquisition; and 49% indicated that — either to "great" or "some extent" — the products were relevant in constitutional and statutory authority decisions.

Next we asked the respondents who had utilized the NCHEMS tools to indicate the planning and management functions they expected to be most important to their institutions in the future. From their answers, we expect that the strategic planning and resource allocation functions will be most important in the future. However, it should be noted that these responses were made from an institutional perspective. Perhaps coordinating/governing board respondents might rate evaluation/reporting/analysis of a higher degree of importance than that assigned by institutional respondents.

3. The Benefits

What are the benefits to be derived from the use of quantitative tools? There is a premise that the management of postsecondary educational institutions can be improved through analytical tools, the use of which brings about *changes in attitudes, understanding, and emphasis on the part of decision-makers.* We asked decision-makers participating in the Phase II survey to indicate whether they believed that decision-makers had changed in their attitudes, understanding, and emphasis through the use of analytical tools. Some 66% of the decision-makers responding to this study believed that such benefits have been derived. There appears to be no difference in the benefits derived across the three types of administrative positions. Institutions which are governed by individual governing boards tended to believe that they had derived these benefits more than institutions which are governed by systems offices. However, multi-campus institution respondents believed that they derived the benefits more often than either individually governed or system-governed institutions. On the other hand, institutions with enrollments of less than 2,000 students believed that they had derived these benefits less than institutions with enrollments above 20,000 students.

This could partially be attributed to the fact that institutions with less than 2,000 students do not tend to utilize computer-based tools. Furthermore, institutions with high and middle scores for effective planning processes realized the benefits of changes in attitudes, understanding, and emphasis more than institutions with lower scores.

There are no significant differences with respect to:

- the quality of data available for decision-making; or
- institutions which have used NCHEMS tools singly or in combination with other tools.

Those which are currently using NCHEMS tools experienced a change in attitude, assumptions and emphasis more than those institutions which are not now using NCHEMS tools. There was no significant difference in the pattern of realizing these benefits with respect to pattern of multi-product use of NCHEMS tools.

When shown a list of sixteen benefits which might be derived from the use of NCHEMS products, the following were selected most often:

- Facilitates reporting to external agencies (including the central or system office);
- Better understanding of our institution's activities;
- Improves design of information system (data base);
- More timely decision-making.

G. ORGANIZATIONAL VALIDITY

Organizational validity refers to the degree to which the decision-making assumptions incorporated in a planning model are consistent with the decision-making processes of individuals, groups and institution which intend to use the model. Organizational validity has been found to be more influential upon the degree to which models are used in decision-making than technical validity — the degree to which the model accomplishes its technical objectives (Schultz and Slevin). We investigated organizational validity from two perspectives — trends which are inherent across all five of the NCHEMS products included in this study; and assumptions which are specific to the individual models.

First, we will review the assumptions which have been made across all products. Questions were asked of those individuals who were familiar with one or more of the five products. There is high concurrence that the management of postsecondary education needs improvement; that improvement may be gained through the use of structural frameworks for information gathering and analysis; that improvement may be gained by the sharing of consistent information brought about by structural mechanisms such as the NCHEMS products; and that more quantitative information leads to better decision-making. There appears to be less concurrence in the manner by which these desirable goals can be achieved. Fifty-two percent of the respondents to this study disagreed that inductive processes could be delayed until a product is field-

tested. However, 84% agreed — either strongly or mildly — that normative models can be deductively developed and can help institutions in their management activities. Thirty-two percent disagreed that the emphasis would be on the macro-analytic or central administrative view with regard to the gathering and analyzing of quantitative information. Fifty-four percent disagreed with the focus on institutional internal information of the present to the exclusion of external effects and uncertainties of the future. Thirty-eight percent disagreed that productivity is the central evaluation measure with respect to institutional performance.

Many of these themes are basic tenets of the analytic, or rational, approach to management. We have indicated that these assumptions are accepted in practice to a certain extent. However, it is also important to recognize that there are other forces which affect the policy formation processes of educational institutions. These forces offer an influence — to a sufficient extent — that the assumptions made by NCHEMS merit consideration for modification to be more consistent with empirical evidence of how decisions are actually made.

In addition to the above general trends, each of the five products was assessed with respect to the organizational validity of the assumptions specifically associated with that product. The assumptions of AUPM tended to be disregarded by those decision-makers who had attempted to use the product. The other four products had a varying pattern with respect to the degree to which the assumptions included in the models' design were appropriate to the decision-making processes of the institutions which used the tools.

H. IMPLICATIONS OF THE FINDINGS OF THIS STUDY WITH RESPECT TO NCHEMS DISSEMINATION STRATEGY

What are the implications of the findings of this study with respect to the research and development activities of NCHEMS? These implications were developed from the perspective of Arthur D. Little, Inc. and Opinion Research Corporation. The general implications appear to be:

- Reconciliation of normative and descriptive decision theory through greater coordination of the basic and applied research activities of the Center;
- Affirmation that NCHEMS dissemination strategy is to disseminate concepts and not just products; and
- Identification of planning and management improvement needs through establishing client/service linkages.

Each of these areas are discussed in Chapter VII of the report. Others who review the report may have different perspectives, and developed other implications from our findings. Such review and interpretations are encouraged.

CHAPTER II

RESEARCH DESIGN, METHODOLOGY, AND DEFINITIONS

A. INTRODUCTION

In this chapter, we review the requirements of the study, the research design we elected to respond to those requirements, modifications made during the study process, and the definitions which we developed.

During the last 15 years there have been many studies conducted on the appropriateness of the use of quantitative tools in decision-making (Gonyea; Evans; Wartgow; Plourde; Heim; Mason; Glenny et al.; Schroeder; Cox et al., Schultz and Slevin). Based upon these experiences, an appropriate research design requires an ability to collect two types of data:

- Data describing a physical reality, such as the existence of a computer-based system; and
- Data describing a perceptional or social reality, such as that perceived by participants in an organization.

The combination of both of these perspectives into one research design presents a challenge. We believe that we have addressed this challenge in our research design. We have focused our efforts primarily upon the assessments of perceptual issues as opposed to the physical realities of information on using computer-based planning tools. Others, such as Plourde, have attempted this approach, but they have not had the proper data collection capabilities for probing, in an in-depth way, the perceptual realities related to the use of quantitative tools in decision-making in postsecondary educational institutions. The study conducted by Cox and others focusing on the use of corporate planning models in business organizations indicates that these problems are not merely unique to educational institutions.

B. REQUIREMENTS FOR THE STUDY

The requirements for this study were set forth in the Request for Proposal (RFP), dated April 20, 1977, which was released by the National Center for Higher Education Management Systems (NCHEMS). This RFP was based upon NCHEMS' previous experience in assessing the impact of its products. These previous efforts were presented in the work conducted by Peggy Heim as Evaluation Officer of NCHEMS and the research design proposed by Abt Associates. Because of discrepancies in expectations and understandings which emerged during the work conducted by Abt Associates, the research design was not accepted by NIE and NCHEMS. A decision was made to release a second competitive-bid RFP for conducting the product impact study. The award was made to Arthur D. Little, Inc., and Opinion Research Corporation on a competitive bid basis.

The study is a joint undertaking between NCHEMS and NIE, the Center's major funding agency. NCHEMS is currently changing its status from a contract agency to a federal research and development center with a special relationship by NIE (Appendix A). In designing the study,

the staffs of NIE and NCHEMS recognized that this study would have multiple audiences and multiple purposes. Because of the multiple audiences and purposes, it was established that, at a minimum, the study was to provide useful assessment and planning information to both NCHEMS and NIE. In addition, information was to be available which would be important to current and prospective users of NCHEMS institutional based products as well as to the postsecondary education research community. Table II-1 indicates the major audiences for this study and presents examples of questions considered important for each audience. These questions were further investigated as a part of our research design and subdivided into issues, concerns, and hypotheses utilized in the formulation of our survey instrument.

TABLE II-1
CONCERNS AND PERSPECTIVES OF VARIOUS AUDIENCES OF NCHEMS PRODUCT IMPACT STUDY

Audience	Question
NCHEMS Board of Directors	How Are Institutional Planning and Management Tasks Carried Out In The Presence of Selected NCHEMS Products? How Do Apparent Impacts Differ by Product, Type of Institution, Management Context, and Other Factors? What Implications for Future Product Research and Development Can Be Identified? How and With What Modifications Can the Design Used for this Study Be Used in Assessment of Impacts of Other NCHEMS Products (for example, State Level Products)?
National Institute of Education	What Impacts of NIE-Supported Product Development Can Be Identified? What Evidence Can be Obtained for the Existence of Such Impacts?
Current and Prospective Product Users	How Do Product Use and Conduct of Management Tasks Differ from One Institutional Setting to Another? What Patterns Emerge That Could be Useful to Those Considering Product Use?
Research Community	What Generalizations Can Be Made about the Conduct of Planning and Management Tasks in the Presence of Quantitative Information-Based Products?

In addition, the study was undertaken within defined parameters. NCHEMS and NIE recognized that a study of this nature would have a potential for addressing a very broad set of issues. In recognition of this possibility, the scope of the study was delimited to:

- Institutional planning and management functions that are most directly germane to specific NCHEMS products;
- Five institutional based products developed by NCHEMS;
- A sample of institutional users of the products included in this study;
- Factors such as managerial approach and institutional context for explanatory power, but an exhaustive treatment of such factors is not required;
- Primary emphasis on understanding how planning and management tasks are carried out in the presence of the NCHEMS products under study.

The RFP suggested a preliminary taxonomy for planning and management functions — planning; resource allocation/budgeting; and analysis/evaluation. This taxonomy has been expanded to a six-component taxonomy (described below) and was utilized in assessing how the results of these products supported the decision-making of post-secondary educational institutions.

Five products were selected to be included in this study:

- Academic Unit Planning and Management (AUPM);
- Costing and Data Management System (CADMS);
- Information Exchange Procedures (IEP);
- Program Classification Structure (PCS); and
- Resource Requirements Prediction Model 1.6 (RRPM 1.6).

These products were designed for institutional use. However, in practice, we found that they have been utilized by central and systems offices, as well as state-level coordinating governing boards. The exact nature of the products, their intended use and conceptual issues, as well as themes consistent throughout all five of the products are discussed in Appendix B. It is assumed throughout the remainder of this report that the reader is familiar with the issues presented in Appendix B.

As stated in the RFP, the products may be used singularly or in combination. We developed representative samples of product use combinations and investigated the degree to which the combinations of various products affect benefits derived. It was expected that the number of institutional users of the products would be quite large. However, the contract did not require us to undertake an exhaustive treatment of the population. A sampling of user institutions was required. The RFP anticipated a purposeful sample, requiring that institutional differences be recognized in the sampling plan. The following typology was suggested:

- Type of institution — two-year, four-year university; and
- Control — such as public and private.

This typology was accepted. In addition, other factors were utilized in selecting our final sample. Based upon initial findings of the study, the purposeful sampling plan we proposed was modified

to include the entire collegiate sector. Because of these modifications, the findings of this study are valid for the entire collegiate sector of institutions (approximately 3,075 institutions and branches recognized by the U.S. Office of Education in 1976) and for the institutions which have ever used one or more of the NCHEMS products discussed above. Therefore, the actual sampling plan of the study exceeded the sampling plan requirements of the RFP.

Because of the nature of the tools involved and the decision-making processes in which the results of the tools are utilized, it was recognized that no one single individual within an institution could likely give the breadth and perspective to assess effectively the utilization of the five products within the institution. Therefore, it was suggested that representatives of various respondent groups be interviewed. Of the positions suggested in the RFP, we proposed a three-part taxonomy of organizational context, as indicated in Table II-2. In conducting the on-site interviews, we gave preference where possible to multiple participation by decision-makers (as opposed to the analytic function) within an institution.

TABLE II-2

CROSSOVER BETWEEN PROPOSED STAFF TAXONOMY AND POSITIONS SUGGESTED BY NCHEMS

Proposed Staff Taxonomy	Positions Suggested by NCHEMS	U.S. Office of Education Position Numbers*
Institutional Management	President Chief Academic Officer Chief Fiscal Officer	01 02 03
Analytical Staff	Planning Officer Institutional Research Director Director of Computing Services	06 47 44
Academic Unit Administrators	Academic Deans Department Heads Faculty Representatives	11-38 – –
Uncertain (Depends Upon Other Institutional Responsibilities)	NCHEMS Liaison	–

*The classification of positions utilized in our sample screening survey was taken from the U.S. Office of Education's "Education Directory – 1976-1977."

It was further recognized that many factors might potentially influence the manner in which management functions are conducted and affected by the results of NCHEMS products. One set of factors, labeled as management approach, encompasses such factors as organizational structure, attitudes and styles of key managers, distribution and informal relationships of individuals within the organization, and the path by which NCHEMS products were introduced into the institution.

A second set of factors relates to environmental context (identified as institutional context within the RFP). These factors include the economic, political, and legal realities and constraints

which are perceived to shape an institution's environment. An exhaustive study of these factors was not required. An investigation into the impact of such factors upon the use of quantitative tools is included in our conceptual framework. It was expected that the study would be conducted in a "case study" manner. First, an in-depth analysis of information collected from individual case studies was to be made. Second, analyses of all cases were to be made to determine trends of impacts and differences across the sample of institutions studied.

The following four dimensions were considered to be the most important in relation to the research methodology:

- Conceptual Design — A guide to the developments of the study and a structure for subsequent analyses of the data;
- Sampling Plan — An indication of how institutions would be selected among the various types using NCHEMS products;
- Interview and data collection plan;
- Analysis plan.

Each of these four elements became part of the design for the study.

C. RESEARCH DESIGN

1. Conceptual Framework

A conceptual framework was used to guide the study efforts and to provide a structure for subsequent analyses of data. The conceptual framework provides explanatory power for investigating: (a) the use of quantitative tools in the management functions of postsecondary educational institutions; and (b) the effect on the use of quantitative tools in institutions, given varying degrees of organizational complexity and specific financial and/or political circumstances.

The conceptual framework was developed in two parts:

- Conceptual framework for product use;
- Conceptual framework for concept awareness.

Both conceptual frameworks are explained below.

The *conceptual framework for product use* was developed to describe patterns of product use. NCHEMS has espoused an informal dissemination strategy during most of the 1970's. During 1977 however, the NCHEMS Board of Directors has assisted the NCHEMS staff in developing a more formal dissemination strategy. While the formal strategy is recent, many of the concepts included in the strategy have been utilized by the NCHEMS staff during most of their previous work, and adapted from Rogers. The initial stage is awareness of the product and the concepts, followed by increased interest in both product and concepts. The next stage consists of an evaluation of the appropriateness of the available product (and its incorporated concepts) for the organization and decisions that have to be addressed. A trial usage of the product follows,

including adaptation of the product to institutional data or using a test data set. Finally there is adoption which may include:

- Rejection of the product and concept;
- Rejection of the product but acceptance of the concept; or
- Acceptant of both the product and the concept

We have investigated the dimensions of this dissemination strategy, from the point of view of NCHEMS, across these five stages, both for those organizations which are currently using NCHEMS tools and those organizations which may have used one or more of the tools in this study, but then may have discontinued their use. Furthermore, we have developed detailed information with respect to the current practice of adapting NCHEMS concepts and tools.

The *conceptual framework for concept awareness* draws upon several bodies of literature, including:

- The *use of quantitative tools in decision-making*, primarily as espoused in previous studies with respect to higher education (including Gonyea; Evans; Wartgow; Bolderson; Plourde; Heim; Abt; Mason; Glenny et al.; Schroeder et al.; Cox et al.; Rourke and Brooks; Brooks; Weathersby; Schultz and Slevin; and Deb);
- *Models of human thought processes* adapted from the work of those who have studied human reasoning over the past few decades, and who have applied this line of reasoning to decision support systems (including Simon and Newell; Bruner; Goodnow and Austin; McKenney; Keen; Bauer and Gergin; Steinbruner; March and Olsen; Rodgers (1975) and Hammond; and Weathersby);
- *Organizational theory* applicable to educational institutions, particularly that which relates and focuses upon choice within an organization and environmental influences (including Balderson; Baldridge et al.; Baldridge-1971; Baldridge-1972; Likert and Likert; and March and Olsen); and
- *Strategic planning* including the influence of the external environment upon planning and management functions of interest in this study (including Paine and Naumes, R.V.L. Wright; and Rodgers).

The above references present the major works in these areas. Obviously, there have been many other themes which have been investigated and documented, both from a theoretical and a practical point of view.

In the area of policy formation and decision-making, over the last 20 to 30 years there have been two major approaches — one normative and the other empirical or descriptive. (In their first major work on policy formation, Bauer and Gergin acknowledged these two different approaches.) The normative approach, which focuses upon how decisions "ought" to be made, has been the primary intellectual framework within which the NCHEMS products included in this study have been developed. At the same time, others have given greater recognition to the empirically-based approach. The acknowledgement of these merging trends is presented by Bauer; and March and Olsen.

The conceptual framework for concept awareness utilized in this study attempts a reconciliation between these two approaches. This reconciliation permits better understanding of the way NCHEMS products are used in decision-making. The framework is intended to provide guidance to those responsible for developing NCHEMS products. We believe that the findings of this study represent an advance in the synthesis of these two research traditions.

Conceptually, the framework utilized in this study is a simple assessment of how decision-making bodies actually make decisions. As shown in Figure II-1, the conceptual scheme is presented in its simplest form. This scheme was primarily adapted from the work of Hammond, as well as the work of other researchers cited above. Note that the decision-making bodies are included as a decision-making unit, as opposed to individuals. Hammond's work was modified because the decision-making bodies of educational institutions function more as collective bodies than individuals (March and Olsen). In fact, Baldridge has noted that the process of who is involved in a particular decision problem is an important aspect of the decision-making process.

The responsible decision-making body is shown in the center of Figure II-1. Infringing upon the decision-making body — and thus affecting the resultant decision — are external forces, i.e., forces external to the decision-making body. We have postulated these "external" forces to be primarily those attributable to management:

- The planning and communication processes of institutions;
- The management philosophies of individuals involved in the decision-making processes;
- The internal environment of the institution; and
- The external environment within which the institution operates.

These external forces not only affect the perception of a problem, but also can directly affect the way in which the analytic function offers assistance to decision makers in solving a problem. For instance, the way decision-making bodies recognize the problem often predetermines the position the decision-making bodies will take with respect to how they expect to respond to the problem. In terms of the analytic function, the previous position of the decision-making bodies may affect the degree to which they utilize information provided by the analytic function. Note that we have utilized a more general concept of the analytic function than analytic staff. This was a modification of our conceptual framework recommended by the NCHEMS Board of Directors in recognition of the fact that the analytic function of small institutions is often performed by line officers who have other responsibilities. In practice, we found that approximately 50% of those who utilize NCHEMS tools do not have an analytic staff, but that the analytic function is actually performed by managers with other responsibilities. This empirical evidence of line managers performing the analytic function modifies, to some extent, the problems and issues presented by Hammond.

Furthermore, the conceptual framework includes the nature and characteristics of the decision problem itself, as well as data relating to decisions. We modified our definition of the applicable decision problem to include both strategic planning and management control problems. Decisions vary according to complexity, degree of structure inherent in them, the amount of data available, and the nature of the data — whether it be quantitative or qualitative — and the importance of the decision to the decision-maker, and to the organization (see Anthony; Anthony and Hertzinger; and Simon and Newell). Because of the increased importance being placed upon

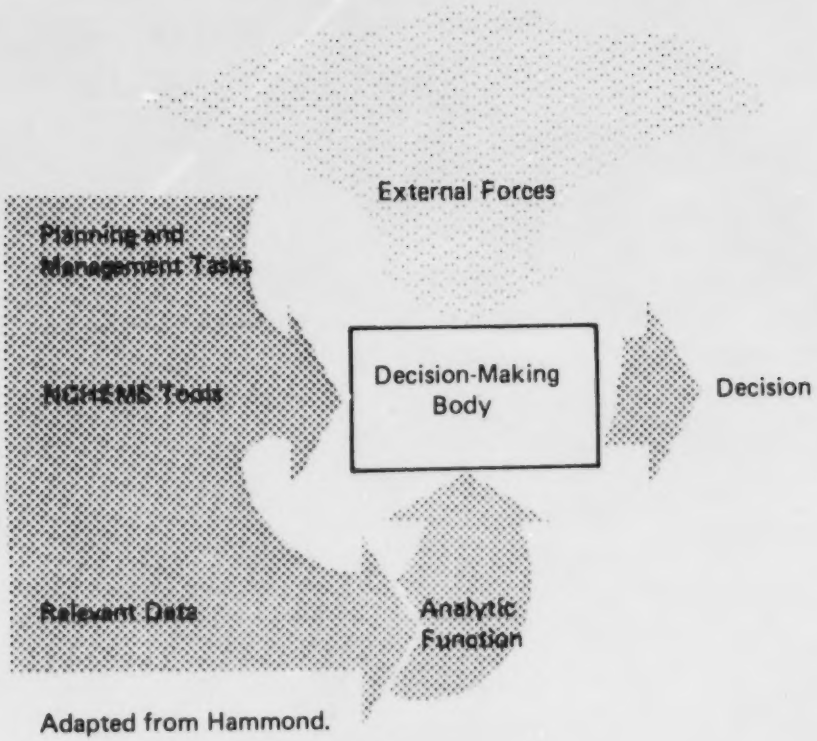


FIGURE II–1 PRELIMINARY CONCEPTUAL FRAMEWORK

FIGURE II–1 PRELIMINARY CONCEPTUAL FRAMEWORK

the strategic planning issues, the importance of structured data available for an operational control system to be directly applicable to policies and problems will perhaps decrease in the future. Therefore, we wanted to be able to assess the difference in the nature and processing of information between strategic planning problems and management control problems. This conceptual framework has been utilized throughout the study. It is presented below in greater detail, with the findings of the study.

2. Sampling Design

In the proposal, Arthur D. Little, Inc., indicated that we intended to interview personnel at 125 institutions and branches which had been identified as having used one or more of the NCHEMS products included in this study. The RFP precluded use of a control group of non-users of NCHEMS products. The original research design is presented in Table II-3. This original design was modified in the negotiations to this study so that a disproportionate sampling based upon product use could be taken.

TABLE II-3

ORIGINAL SAMPLE PLAN

Institutional Type / Institutional Control	2 Year	4 Year	University	Total
Public	25	25	25	75
Private	0	25	25	50
Totals	25	50	50	125

In formulating the original sampling design, the scope of work was based on the assumption that NCHEMS would provide Arthur D. Little with a list of those institutions which have utilized the five NCHEMS products covered in this study. In addition, the sampling design assumed that the list could be used to appropriately sample multi-product users and thus determine any potential synergistic benefits which might accrue to an institution. However, it was determined that the users list maintained by NCHEMS was inappropriate for the following reasons:

- It was not entirely up-to-date or accurate.
- Many individuals and institutions can order products without a commitment to implementing them, because the products are inexpensive. As Paul Plourde found in his recent study: "Access to the products does not mean use" (Plourde).
- Individuals and/or institutions might acquire the products through channels other than that of purchasing the products from NCHEMS, e.g., as gifts from other institutions or systems or through computer facilities.
- The distribution of RRPM 1.6 has been included with the CADMS over the last two or three years. Therefore, it would be difficult to discriminate between and among our RRPM 1.6 users and the CADMS users.

- PCS is used by all collegiate institutions of higher education to complete the annual Higher Education General Information Survey (HEGIS).
- It would not permit determining the degree of technical installation for the products, such as a pilot implementation, continued maintenance, or discontinuation of use.
- It would not permit determining the degree to which users understand the management concepts imbedded in the products.
- Because of the lack of clarity on product use, our original sampling plan would not permit us to appropriately measure multi-product use as requested in the RFP.

The solution to this data deficiency was to utilize a national telephone screening survey of a representative sample (approximately 1500 institutions) of the entire collegiate sector of educational institutions. There were approximately 3,075 collegiate institutions recognized by the U.S. Commissioner of Education in 1976-1977.

With the above reservations in mind, the sampling plan was conducted in two phases: Their objectives were:

Phase I — Identify a sample of collegiate sector institutions which have used one or more of the five NCHEMS products in the study. A side benefit of Phase I interviewing was an estimate of the awareness and use of NCHEMS products and concepts.

Phase II — Gain insights into the dissemination and use of the five NCHEMS products among those institutions where the products had ever been in use.

The sampling plan for each of the two phases is presented below:

a. Phase I — National Screening Survey

During the period November 21 to December 13, 1977, some 1,506 telephone interviews were conducted with institutions and branches recognized by the U.S. Office of Education and included in their "General Directory." Calls were made by members of Opinion Research Corporation's (ORC) trained telephone interviewing staff from its central facility in Princeton, New Jersey.

The sample institutions were selected from the U.S. Office of Education's General Directory tape for 1976-1977. To assure an unbiased sample, all institutions with even-numbered Federal Inter-Agency Commission on Education (FICE) codes were designated as the original sample. When alternates were required (see Table II-4), the institution with the matching odd-numbered FICE code was used. Table II-4 shows that the overall response rate was 82%, a rate considered high in the survey research field. This response rate reflects an interest in the study on the part of the respondents, and implies a high degree of rapport with the respondents.

The sample design for this screening survey was based upon excluding central and systems offices, as well as other institutions not recognized by the U.S. Office of Education's General Directory as being part of the collegiate sector. Unfortunately, the sample of institutions taken from the 1976-1977 U.S.O.E. General Directory tape included 3,473 institutions, branches and other organizational entities with FICE numbers. Included in this sample were systems and

TABLE II-4

INTERVIEW PROFILE – PHASE I

	Number of Institutions
Total contacted for interview	1,829
Completed interviews	1,506
Refusals	82
Appropriate person not available for interview during interviewing period	241

central offices, as well as other institutions, which were eligible for listing in the collegiate sector, and some selected support organizations. The interviewers were instructed to remove these institutions from the sample, and alternate institutions were selected for interviewing. However, because some of the titles of the institutions did not indicate that they were central or systems offices, and other institutions appeared to be valid educational institutions, 80 cases were actually interviewed. Thus, the final set of interviews breaks down to those listed in Table II-5. The 1,426 collegiate sector institutions provide a valid sample for the purposes of this study.

TABLE II-5

ACTUAL INTERVIEW BREAKDOWN – PHASE I

	Number of Institutions
Total interviews	1,506
Colleges and universities	1,426
Systems offices, central offices, and other institutions included in the U.S. Office of Education General Directory	80

The spokesperson for each institution was the person knowledgeable of the analytic function for that institution — the person who would know about the use of analytical tools at the institution. As suggested by members of the Implementation and Evaluation Committee of the NCHEMS Board of Directors, Arthur D. Little developed a screening process to differentiate institutions with enrollments less than 2,500 students, and those with enrollments greater than 2,500 students:

- For institutions with 2,500 or less, the interviewers were instructed to interview the President, unless he or she referred the interviewer to another person for the interview. The interviewer was provided with the name of the President.

- For institutions with more than 2,500, the interviewers were instructed to contact a specific person identified by title and name from the U.S.O.E. General Directory. The titles which we assumed to be included in the analytical function were:
  - — Chief Planning Officer;
  - — Director, Computer Center;
  - — Director, Information Office; and/or
  - — Director, Institutional Studies.
- Where possible, the interviewers were provided with the name of the person to contact, as taken from the U.S.O.E. General Directory tape. In those cases where a name was not included in the tape, the interviewer was instructed to contact the President's secretary and ask for the name of the person knowledgeable of the institution's analytical function.

Altogether, 108 chief executive officers participated in the sample of collegiate sector institutions, as well as 1,318 administrators with other responsibilities. An additional 80 administrators from the central and systems offices and other institutions participated in the survey, which totals 1,506 persons interviewed for the study. Table II-6 presents a comparison of the characteristics of the universe of collegiate sector institutions and branches with those institutions participating in the telephone screening survey. The sample is representative of the population.

TABLE II-6

COMPARISON OF COLLEGIATE SECTOR AND PHASE I SAMPLE

	Universe	Sample
Number	3,075	1,426
OBE Region		
New England	8%	9%
Middle Atlantic	20	18
Great Lakes	16	17
Plains	11	10
Southeast	22	24
Southwest	7	7
Rocky Mountains	3	3
Far West	12	12
Other (outlying areas and service academies)	1	0
Type		
University	5%	6%
Four-year institutions and other specialized colleges	58	56
Two-year colleges	37	38
Control		
Public	48%	51%
Private	52	49
Size		
Less than 2,000 enrollment	59%	57%
2,000 enrollment and over	41	43

In the interpretation of Phase I results, the terms "use" and "user" as applied to the five NCHEMS products were derived from the question: "...please tell me whether or not your institution has ever used (PRODUCT)..." We acknowledge that some institutions may have been using a NCHEMS product and the spokesperson for the institution may not have been aware of its use by name. Similarly, the concept of a product may have been adopted by an institution without actually adopting the product. Notice, too, that the question refers to "ever" using the product.

For a discussion of the reliability of survey percentages, see the Phase I report — *National Survey of the Impact of Selected Products Developed by NCHEMS*, 1978.

b. Phase II — On-Site Interviewing

During the period March 3 - April 6, 1978, some 126 institutions were visited by ORC executive interviewers and 440 personal interviews were conducted.

The sample for Phase II was selected from the results of Phase I. In Phase I some 372 institutions were identified as users (past or present) of one or more of the five NCHEMS products included in the study. These were distributed by type and control as shown in the first column of Table II-7.

TABLE II-7

BREAKDOWN OF NCHEMS PRODUCT USERS

	Phase I Subsample User Institutions	Included in Personal Interview Sample		
		With Certainty	Every 4th	Total
Public — Universities	24	24	—	24
Other four-year colleges	113	—	28	28
Two-year colleges	135	—	34	34
Private — Universities	11	11	—	11
Other four-year colleges	82	—	21	21
Two-year colleges	7	7	—	7
Total	372			125

Because of the small number of cases in three of the groups (public and private universities and private two-year colleges), the decision was made to include all such institutions in the final sample for personal interviewing. In the remaining three groups, every fourth institution was included in the sample, as shown in Table II-7, and —

- Selection of every fourth institution was stratified by product mix; and
- A weighting procedure compensated for the unequal probabilities of selection that resulted from the disproportionate sampling.

After the initial selection of the sample, geographic location was checked for interviewer coverage. In a few cases where substantial travel would have been involved, substitutions were made. It should be noted here that ORC's staff of over 1,200 interviewers is strategically located to cover a national probability sample of the general public. Consequently, little, if any, bias is introduced by geographic substitutions. Insofar as possible, substitutions were purposely matched to geographic region, type and control, size of institution, and size of place.

Subsequent to the initial sample selection, further substitutions were made when, for one reason or another, it was impossible to complete interviews at an originally selected institution. Altogether 175 institutions were contacted for participation in the study:

- The contact was initiated by a mailing (including two letters) addressed to the Phase I respondent — a letter from Dr. Marvin Wachman, Chairman of the NCHEMS Board of Directors, which introduced the study and described its purpose; and a letter from Isabelle N. Rhodes, ORC Vice President, which described the nature of participation, the time and people involved.
- The second contact was a telephone call placed from ORC's Princeton office to confirm readiness at the institution for the field interviewer's call;
- The next contact was the interviewer's telephone call for an appointment to visit the campus and conduct the interviews; and
- At the time of the interviewer's visit, individual personal interviews were conducted with the President, whenever possible, other institutional management people, academic management people, and the person responsible for the analytic function.

Among the 175 institutions selected originally, or as alternates, 126 institutions participated within a time frame suitable for their questionnaires to be included in the quantitative analysis. The distribution of the outcome of ORC's contacts is shown in Table II-8.

The response rate of 74% (129/175) is, generally, an acceptable level for survey research, providing there is reasonable assurance that willingness to participate is not related to, or a function of, the research findings themselves. To some extent, in the present study, we do not have this assurance. In some cases (Table II-8), non-participation in the study is related to the institution's negative attitude to NCHEMS and its products. The implication that this has on the research is that the findings of the study should be interpreted as descriptive of the climate at user institutions receptive to NCHEMS products and concepts. With this restriction in mind, we feel that the study provides valuable insight concerning NCHEMS products and their application.

The disproportionate sampling, described earlier in this section, required the application of design weights to the results. Weights were also introduced in the final tabulations of the Phase II results to bring the sample in close agreement with the universe described in Phase I. Table II-9 shows the comparison of these two distributions.

3. Interview Data Collection Plan

The interviewing and data collection plan for this study was executed by Opinion Research Corporation. To empirically assess our conceptual framework, both evaluative information and

TABLE II-8

PROFILE OF RESULTS OF ORC INTERVIEWS

	Number of Institutions
Original sample selection	125
Alternates selected	50
Total contacts	175
Completed interviews, processed	126
Completed interviews, received too late for processing	3
Total completed interviews	129
Major reasons for nonparticipation:	
No longer use NCHEMS products	17
Unwilling to take the time, or people not available during the interviewing period	6
Senior level administration unwilling	5
Refused without a specific reason	6
Other reasons	16

TABLE II-9

COMPARISON OF TWO DISTRIBUTIONS

	Universe	Weighted Sample
New England	8%	8%
Middle Atlantic	17	17
Great Lakes	15	15
Plains	14	14
South East	24	25
South West	4	4
Rocky Mountains	6	5
Far West	12	12
Under 2,000 enrollment	33%	30%
2,000 – 19,999	62	65
20,000 and over	5	5
Public universities	7%	6%
Other 4-year public	30	28
Two-year public	36	37
Private universities	3	2
Other 4-year private	22	25
Two-year private	2	2

opinions were required, complemented by certain factual information pertaining to the use of quantitative tools and the computer capabilities of institutions. These types of data were determined to be unavailable from secondary data sources and primary data collection was required. During Phase I, a national screening telephone survey was utilized to ascertain:

- Product awareness (Question 1);
- Product use (Questions 2, 3 and 4); and
- Concept awareness (Questions 5 and 6).

Approximately 5-minute interviews were conducted with the person responsible for analytic functions as described above in the sampling plan. The interview guide is presented in Appendix C. Telephone interviewing proved to be a very effective mechanism for conducting the screening survey and more effective than using mailed questionnaires. Through the utilization of the U.S.O.E. General Directory tape, we were able to control for potential bias which may have resulted from non-response of mailed questionnaires, as used by Plourde and Heim.

During Phase II, information was collected through personal interviewing (See Appendix D). ORC executive interviewers were utilized to conduct interviews during a one-day period at each of 126 institutions. The interviewers were instructed to conduct one interview with the person in charge of the analytic function and at least one interview with a representative of general management level as well as the academic support unit level. Where time permitted, additional interviews were to be conducted with decision-makers. In total, 440 personal inter-

views were conducted at 126 institutions. Interviews were conducted at three additional institutions, but the interview forms were received in Princeton too late for processing. Table II-10 summarizes those interviewed by constituent groups.

TABLE II-10

SUMMARY OF INTERVIEWS BY CONSTITUENT GROUPS

	Total Unweighted	Weighted	%
Institutional Management (14% of total sample were Presidents, Chancellors, or Provosts)	187	510	–
Academic Management	125	359	–
Analytic Function	128	367	–
	440	1,236	

4. Analysis Plan

Analysis of the data from the Phase II personal interviews was conducted by cross tabulating the results of each question by a standard set of independent variables. The independent variables utilized are presented in Table II-11, indicating the name of the independent variable, its definition, and the source of the data we utilized to construct the variables.

There were two major populations of respondents for the Phase II interviewing, 1) decision-makers and 2) institutions. The decision-makers studied include three groups:

- Institutional management;
- Academic unit management; and
- Analytic function personnel.

The data for decision-makers were derived from Form A of the Phase II questionnaire. The institutional data was derived from analytic function personnel interviews, Form B. The results of the Phase II interviewing are also weighted to approximate the population of NCHEMS users. The reliability of the sample and tests of significance utilized are summarized in Appendix E.

D. DEFINITIONS

1. Taxonomy of Planning and Management Tasks of Postsecondary Educational Institutions

The objective of this study was to examine how certain postsecondary education management tasks are performed at a sample of institutions which utilize selected products developed by NCHEMS. To describe how these tasks are performed, we developed a taxonomy of planning and management tasks that are performed by postsecondary educational institutions.

TABLE II-11

DEFINITION OF INDEPENDENT VARIABLES

Independent Variables	Definition	Source of Data to Construct Variable
Organizational Context of Decision Maker (Type of Respondent)	Institutional Management Academic Management Analytic Function Personnel	Respondent identified according to definitions
Type and Control of Institution	Type – University – Four Year and Other – Two year Control – Public – Private	U.S. Office of Education Institutional Characteristics Tape – 1976-77
Governance Structure	Single Institution Board Multi-campus Institution Multi-campus System	U.S. Office of Education Institutional Characteristics Tape – 1976-77
Enrollment Size	Head count enrollment	U.S. Office of Education Institutional Characteristics Tape – 1976-77
Performance of Analytic Function	Line manager with other responsibilities or analytic staff	Reported by person in charge of analytic function
Beliefes in the Role of Professional Management in Postsecondary Education	Belief in the balance in application of management science techniques and understanding the educational environment	Scoring of responses to question number A-7 into high, medium, and low groups
Effective Planning Processes	Effective planning processes based upon seven characteristics	Scoring of responses to question number A-6 into high, medium, and low groups
Quality of Data Available for Decision Making	Users assessment of quality of data available for decision making at their institution	Scoring of responses to question number A-9 into high, medium, and low groups
Use of Computer Based Tools	Use of computer-based tools, either developed by the institution; or acquired through NCHEMS or other sources	Response to Questions B-2 and B-4
NCHEMS tools used	Use of NCHEMS tools	Response to question B-4

The taxonomy proposed in the Request for Proposal identified planning and management functions in the following categories:

- Planning;
- Resource allocation/budgeting; and
- Analysis/evaluation.

We expanded this taxonomy to one which is based upon two major elements of the management process:

- *The strategic planning process* — Activities undertaken to select the broad mission, goals, and objectives of an institution or system (Andrews; Leonard; Paine and Naumes; and Rodgers); and
- *The management control process* — Activities by which administrators (and other constituents) assure that resources (human, financial, and physical) are obtained and used effectively and efficiently in the accomplishment of an institution's or system's elected objectives (Schroeder et al.; Anthony and Hertzinger).

From a conceptual point of view, we believe that these elements of the management process are comparable, regardless of whether the organizational entity, or corporate body, is: (a) a single institution or system of institutions (under a single corporate body); or (b) incorporated as a public or private organization. We believe that there may be differences in the functioning of the management process where intersegmental or interinstitutional planning and management activities are involved in which two or more corporate entities are included. An example of this intersegmental planning is the California Library Authority for Systems Services (CLASS Bylaws), authorized by the Legislature of California to facilitate intersegmental library planning between and among the University of California, the California State Colleges and Universities, the community colleges, and the State's public and special libraries. An example of interinstitutional planning and management is the six institutions which comprise the Atlanta University Center — each institution has its own autonomous governing board and belongs to the separately incorporated Atlanta University Center Corporation (Read).

We further assume, corroborated by both accepted theory and currently accepted best professional practice, that the manner in which these two elements of the management process are executed varies considerably from institutional setting to institutional setting. In fact, this assumption leads us to draw upon several bodies of knowledge related to describing and understanding the management process, both for all organizations, generally, and for educational institutions specifically. To understand these diverse management processes, we require a conceptual framework drawn from organizational theory — the study of modern administrative organization, which produces both goods and services. Our interest in this study is related to those institutions which primarily produce services, as opposed to tangible goods (Anthony and Hertzinger). The characteristics of modern organizations specifically related to educational institutions include such phenomena as:

- Growth of technological knowledge and special expertise therein;
- A particular set of culturally determined and transmitted relationships between superior and subordinate roles (Thompson); and

- A parallel authority of professionals employed in a modern organization, such as an educational institution (Baldridge, Moore, Blau, Parsons and Platt).

These and other characteristics result in a particular kind of ordered human social system known as a modern organization. The study of these systems is called organizational theory, which attempts to "explain the part of human behavior that is determined by the social structures that create order within these social systems" (Thompson).

In addition to organizational structure, perhaps comparable to the study of the anatomy of the human body, human organizations have ideologies and bodies of values and beliefs which guide their decisions. This study is perhaps analogous to the study of the physiology of the human body. It is this ideology which distinguishes human organizations from other forms of productive organizations, such as the beehive and the ant colony. It is the existence of these ideologies which leads to the study of decision-making, which may be undertaken from two points of view (Rodgers — 1978):

- *Normative decision theory* — primarily based upon deductive reasoning, which focuses upon how decisions ought to be made, and is concerned with decision rules which organizations utilize to justify their actions (Balderson; Weathersby); or
- *Descriptive decision theory* — primarily based upon inductive reasoning, which attempts to explain and describe how decisions are actually made by observing such decisions (Bauer and Gergen; Bauer; Paine and Naumes).

The study of decision-making in educational institutions is further characterized by the recognition that decisions are seldom made by a single individual, but usually are actually made by a collective body of individuals. The study of collective decision-making draws upon several bodies of knowledge, including conflict theory, community power studies, and interest groups in organizations, suggested by Baldridge, as well as research on interpersonal relationships, such as that conducted by Likert and Likert. The conclusion that one can draw from this body of research is that there are many conceptual views accepted in practice and currently utilized by researchers concerned about the management of postsecondary educational institutions.

As one reviews the development of this research, it appears that the divisions between normative theory and descriptive theory appear to be becoming less rigid. For instance, in their noted work in policy formation, Bauer and Gergen recognized the difference between normative and descriptive decision theory. Subsequently in his work, Bauer, in 1974, began to believe that these two bodies of knowledge about decision-making processes in non-profit organizations were beginning to converge. This trend is also chronicled by the work of Corwin; Paine and Naumes; and Rodgers (1978). This trend is corroborated by the findings of our Phase II survey in which it was found that the conceptual approach permits describing the factors affecting the decision-making processes of educational institutions; the use of data in decision-making; and the use of the results derived from selected NCHEMS products.

Therefore, the proposed taxonomy permits describing both the way in which analytical tools have been used in the management processes, and to identify the current and future needs for analytical support for the planning and management functions of postsecondary educational institutions. This taxonomy will permit assessing the current congruence between normative and

descriptive decision theory, and to continue to assess the degree to which these two major research traditions provide mutually supporting capabilities to explain how decisions are made in educational institutions.

The taxonomy is as follows. The strategic planning process consists of the following two functions:

- Constitutional authority allocations; and
- Strategic planning.

The management control process consists of the following functions:

- Resource acquisition;
- Resource allocation;
- Institutional management and control; and
- Reporting, analysis, and evaluation.

Definitions of each of these six functions are provided below.

The strategic planning process includes:

- *Constitutional Authority allocations* — includes establishing the corporate authority of an educational institution or system, such as a charter, legislation, or administrative code; authorizing degree-granting authority and licensure; and the allocation of differentiated authority and responsibility for the governance and management of such an institution or system, which may be specified in the form of a charter, legislation, administrative code, or bylaws.
- *Strategic planning* — identifying relevant challenges and opportunities from the external environment and comparing those challenges to current and potential internal capabilities; determining broad mission, goals, and objectives of the institution and/or system; designing strategic action plans for meeting those objectives; identifying the need for financial, human, and physical resources to carry out those plans; gaining membership in appropriate regional and/or program accreditation; monitoring the on-going performance to ensure that the desired ends are being accomplished; altering the mission, objectives, and actions as appropriate; and facilitating the interpersonal and intergroup relationships within the institutions and/or systems to encourage the accomplishment of desired performance levels (Andrews; Likert and Likert; Paine and Naumes; Leonard et al.; Wright, Rodgers, 1976).

The management control process consists of the following tasks:

- *Resource acquisition* — the function of acquiring the resources necessary to accomplish the selected mission and goals of an institution or system. This function includes the acquisition of human, financial, and physical resources necessary to realize the selected mission, goals and objectives. The resource acquisition process may differ according to the specific organizational content. Financial resources

may be acquired from governmental sources, such as Federal, state, and local sources, private foundations and corporations, individuals, alumni, and other constituent groups.

- *Resource allocation* — distributing resources within an institution or system. This function pertains to the manner in which resources are allocated to achieve the mission, goal, and objectives of the institution or system, and the various influences which affect those resource allocation processes;
- *Institutional management and control* — implementing plans to accomplish established institutional objectives. These tasks are usually related to the day-to-day administration of an institution or system of institutions.
- *Reporting, analysis, and evaluation* — conducting the audit function based upon data derived from the institution or sources external to the institution; analytical tools and techniques, as well as professional opinions, values, and other influences to assess the performance (both effectiveness and efficiency) of the institution or system in realizing its mission, goals, and objectives.

There are other taxonomies of planning and management tasks which have been suggested by Baldridge; Helsaback; Anthony and Hertzinger; Schroeder et al.; and Fielden and Lockwood. The above taxonomy was determined to be best suited for this study and the future policy considerations of the National Center for Higher Education Management Systems.

2. Sectors of Postsecondary Educational Institutions

The NCHEMS mission is to improve the planning and management functions of postsecondary education. The concept of postsecondary education entered into the national policy discussion as a result of the Educational Amendments of 1972. Among other new directions, the Amendments established the requirement for a National Commission on Financing Postsecondary Education to investigate a variety of policy issues with respect to postsecondary education. One result of this Commission was the formation of a working definition of postsecondary education. We would like to briefly review here the working definition suggested by the Commission, as well as further modifications undertaken by Arthur D. Little, Inc., in a recent study for the Massachusetts "1202" Commission.

There are two levels of education of concern here: postsecondary (or non-compulsory) education and elementary and secondary (or compulsory) education. It is important to keep the distinction clear because the articulation between secondary and postsecondary education is not so precise as it may first appear.

Postsecondary education is defined as:

"...consists of formal instruction, research, public service, and other learning opportunities offered by educational institutions that primarily serve persons who have completed secondary education, or who are beyond the compulsory school attendance age, and that are accredited by agencies officially recognized for that purpose by the U.S. Office of Education, or otherwise eligible to participate in federal programs" (The National Commission on Financing Postsecondary Education).

Secondary (or compulsory) education is defined as:

"...academic, vocational, technical, home study, business, comprehensive, or other school or organization or person offering education credentials or offering instruction in education to persons who are in the pursuit of a high school diploma or its equivalent."

The reason that the articulation between secondary and postsecondary education is imprecise is that vocational and technical education are offered in both sectors and, indeed, may actually be offered by the same institution. This duality is important with respect to the state-level agencies responsible for the licensure function and the recognition of vocational institutions.

We will next review the three major sectors of the postsecondary education:

- The collegiate sector;
- The non-collegiate (or occupational/ vocational) sector; and
- Other postsecondary educational learning opportunities.

In the collegiate sector (generally known as higher education), the participants are eligible for federal aid from the Federal Veterans Benefits or Social Security student aid programs. The degree programs offered are generally designed for the attainment of an Associate degree (or higher). In the vocational programs offered by collegiate institutions, however, there are some programs offered which do not lead to an Associate degree. For purposes of this study, we have identified three major levels of the collegiate sector:

- Universities — Institutions offering doctoral degrees, which are engaged in research and public service functions;
- Four-year and other specialized institutions — Institutions offering instruction at the collegiate level leading to Bachelor's or Master's degrees, or offering occupational programs leading to an Associate's degree, diploma, or certificate below the Bachelor's degree; these institutions include specialized and single-purpose institutions, as well as comprehensive institutions below the doctoral degree level; and
- Junior and community colleges (two-year institutions) — Institutions offering the first two or three years of college instruction, leading towards a certificate or an Associate's degree.

There are other taxonomies of postsecondary educational institutions, notably that developed by the Carnegie Commission in 1973 and others developed by NCHEMS. However, for the purposes of this study, we believed that these three levels would provide sufficient detail to investigate the use of quantitative tools in the collegiate sector. Further disaggregation would not be possible within the total sample of 125 institutions.

Briefly we will review the other two sectors of postsecondary education:

- The non-collegiate (or occupational/ vocational) sector; and
- Other postsecondary educational learning experiences.

The occupational/vocational sector institutions are eligible for Federal Veterans Benefits or Social Security student aid programs and their programs are designed for the attainment of a certificate, diploma, or other educational credential not defined as a degree, but not wholly applicable to the attainment of an Associate degree or higher. These institutions do not have collegiate authority, and may or may not be coordinated under the jurisdiction of the agency responsible for granting collegiate authority. The U.S. Office of Education has suggested a taxonomy for these types of institutions which is presented in Table II-12. The National Commission on Financing Postsecondary Education divided these categories into two major categories:

- Technical institutes and trade schools; and
- Others (including business, cosmetology, flight, hospital, and tech-vocational schools).

The remaining learning opportunities for postsecondary education represent institutions not included as a part of the collegiate or the occupational/vocational education sectors, and are designed primarily for vocational, avocational, or recreational purposes. Note that the distinction between the previous two sectors and this sector is based upon eligibility for Veterans Benefits or Social Security student aid programs. All of the training programs offered by organizations for their own employees and not recognized by an official state agency as representing transferable credit would be included under these types of institutions.

It is important to keep in mind the above considerations when assessing the use of the five NCHEMS products included in this study. The postsecondary education community is a diverse set of institutions and organizations offering a variety of programs. Those individuals seeking postsecondary education services have an equally diverse set of aspirations, needs, and capabilities. To provide an effective research program to respond to this diverse set of needs, it is essential to establish a fundamental linkage between recognizing and understanding the diversity of the postsecondary education community and responding with a research program to address this diversity. The exact level of addressing this diversity through explicit market segmentation is a matter of policy for NCHEMS Board of Directors.

3. Structural Context

The concept of structural context utilized in this study was adopted from the work of Joseph Bower in researching the capital investment processes of corporate organizations. The influence of structural context has largely been overlooked by others who have researched the use of quantitative tools in educational institutions (Gonyea; Evans; Wartgow; Heim; and Plourde). Instead, these studies have focused upon individual positions, such as president, vice president for academic affairs, business affairs, and other major positions commonly associated with educational institutions. Indeed, many of NCHEMS discussions have been focused upon the difference in perspectives between the chief financial officer and the chief academic officer. These discussions notwithstanding, other research indicates the importance of structural context in assessing the degree to which quantitative tools, as well as other factors, affect the decision-making processes of educational institutions.

Bower developed a three-part model of structural context:

- *Definition* — The process by which basic technical and economic characteristics of a proposed investment project are determined;

TABLE II-12

DEFINITIONS OF PROPOSED FRAMEWORK

LEVELS OF EDUCATION	SECTORS	LEVELS OF INSTITUTIONS
POSTSECONDARY **(noncompulsory)** **Defined as academic, vocational, technical, home study, business, professional, other school, college, university, or other organization or person offering educational credentials or offering instruction or educational services primarily to persons who have a high school diploma or its equivalent for attainment of educational, professional, or vocational objectives.**	COLLEGIATE Collegiate Sector Education – A subset of post secondary education known as higher education. Participants are eligible for Federal Veteran's Benefits or Social Security student aid programs, and the programs are designed for the attainment of an Associate's or higher degree. NONCOLLEGIATE Noncollegiate Sector Education – A subset of post secondary education eligible for Federal Veteran's Benefits or Social Security student aid programs and designed for the attainment of a certificate, diploma, or other educational credential not defined as a degree or not wholly applicable to the attainment of an Associate's or higher degree. OTHER OTHER POST SECONDARY EDUCATION – Post secondary education not included as a part of collegiate or noncollegiate post secondary education designed primarily for vocational, avocational, and recreational purposes. Note that the distinction between noncollegiate and other post secondary education is based upon eligibility for Veteran's benefits or Social Security Student Aid Program. Unions and employers no data.	GREATER THAN 4 YEARS • greater than four year institutions – institutions providing education at the graduate or masters level and above, including doctoral granting in research universities and other specialized graduate and professional institutions. 4 YEAR • four year college – an institution offering the instruction at the collegiate level leading to a bachelor's degree. It frequently offers occupational programs leading to an associate's degree, a diploma, or certificate below the baccalaureate. JUNIOR/COMMUNITY COLLEGES • junior community college – an institution offering the first two or three years of college instruction. It frequently grants a certificate or an associate degree, but not a bachelor's degree. OCCUPATIONAL INSTITUTIONS • occupational institutions – a variety of educational institutions which provide occupational vocational education requiring a high school diploma or its equivalent for entrance, and providing educational programs at less than the associate degree level. Under this category are included the following institutions according to the U.S. Office of Education, Taxonomy for Public Private Post Secondary Vocational Schools: • TECHNICAL OR VOCATIONAL SCHOOL. A school used exclusively or principally for providing vocational education to persons who have completed or left high school and who are available for full time study. • TECHNICAL INSTITUTE. A public or nonpublic institution offering instruction in one of more of the technologies. • BUSINESS/COMMERCIAL SCHOOL. A nonpublic educational institution offering courses for business occupations, such as accounting, data processing, secretarial. • COSMETOLOGY SCHOOL. A school offering programs in beauty treatments, such as care and beautification of hair, complexion, and hands. • FLIGHT SCHOOL. A school offering programs for work as an aircraft mechanic, pilot, or other technical fields related to aviation. • TRADE SCHOOL. A nonpublic educational institution offering courses for trade occupations, such as welding, barbering, auto mechanics. • CORRESPONDENCE SCHOOL. An institution offering instruction only through the systematic exchange between teacher and student of materials sent by mail. No facilities are available for resident students. • HOSPITAL SCHOOL. A hospital, sanatorium, or convalescent home offering instruction for medical and paramedical occupations. • JUNIOR/COMMUNITY COLLEGE. An institution offering the first 2 or 3 years of college instruction. It frequently grants a certificate or an associate degree but not a bachelor's degree. • COLLEGE. An institution offering instruction at the college level leading to a bachelor's or higher degree. It frequently offers occupational programs leading to an associate degree, diploma, or certificate below the baccalaureate. • OTHER EXAMPLES (no complete taxonomy) Trade unions, employers, other learning experiences.
SECONDARY **(compulsory)** **Secondary Education activity is defined as academic, vocational, technical, home study, business, comprehensive, other school, or other organizations or person offering educational credentials or offering instruction or educational service to persons who are in pursuit of a high school diploma or its equivalent.**	NO DIFFERENTIATED SECTORS	COMPREHENSIVE HIGH SCHOOLS • Comprehensive Schools – Secondary schools which offer both academic and vocational programs. REGIONAL VOCATIONAL TECHNICAL SCHOOLS • Regional Vocational Technical Schools which provide vocational technical education for citizens of member cities and towns by pre-arranged agreement. TECHNICAL AND TRADE SCHOOLS • Technical Trade Schools – specialized technical and trade schools which provide vocational technical education.

- *Impetus* — The forces that move a project toward funding, including the willingness of a general manager at the division president's level, or one level below, to commit himself to sponsor a project in the counsel of division officers and before the division general manager;
- *Context* — The set of organizational forces that influences the processes of definition and impetus (Bower).

Bower distinguished context into two subsets. The first subset of elements was designed as corporate structure, the formal organization (with associated definition of manager's roles); the system of information and control used to measure performance; and the system used to measure and reward performance of managers. The other subset was defined as situational context which included factors of personal and historical nature. Our interest here is in the subset of context, referred to as corporate structure. Bower found that the corporate structure had an important influence upon the capital investment decisions investigated.

The structural context defined for this study includes the following:

- *Institutional Management* — General officers of an educational institution responsible for institutional-wide decisions;
- *Academic Unit Management* — The general management of an academic unit of an educational institution. In general, these managers are primarily faculty members who have assumed administrative responsibilities. Their perspectives, interests, and concerns primarily relate to the academic unit with which they are affiliated.
- *Analytic Function* — The performance of the process of defining problems, understanding external and internal relationships, and gathering data and performing analysis with respect to those decision problems. The analytic function may be performed by an analytic staff whose sole function is related to the analytic function, or it may be performed by line managers who, in addition, share other line responsibilities.

This definition of structural context has one major limitation: *it omits the governing board, which leads to the next section.*

4. Coordinating/Governing Boards

The RFP for this study indicated that products included have an institutional-level focus, as opposed to a state-level focus. In the past, these two distinctions have been utilized in the characterization of the potential audiences for products developed by NCHEMS. After more detailed investigations of this study, these two distinctions were determined to be inadequate. They are not mutually exclusive in that some institutional-level bodies are also state-wide bodies, such as a statewide system of community colleges which shared a common governing board. Other educational research organizations use other definitions of segmenting institutions that deliver and govern education. Arthur D. Little proposes that NCHEMS broaden its two categories of target audiences as cited above. Please note (as presented above) that the products included in this study, while primarily designed for institutional-level concerns, have been utilized by coordinating/governing boards who have a state-wide focus. Coordinating governing boards represent a "fuzzy" part of the segmentation effort — some governing boards govern only one institution, while central office or system governing boards govern several institutions.

Arthur D. Little has not collected primary data with respect to the definitions of coordinating/governing boards. Important insights may be gained from a study conducted by Gomberg and Atelsek for the Association of Governing Boards of Universities and Colleges. Note Table II-13, which indicates governing boards and institutions governed by control. In total there are approximately 2,300 boards which govern over 3,000 institutions and branches. (Note in Table II-13 that the figure of number of institutions governed, 3,036, is appropriate for the fall, 1974. For the other analyses of this study we utilized the 1976 figure which is 3,075.) Note an important distinction. There are 2,150 single campus governing boards which govern approximately one half of the full-time, equivalent enrollment for 1974. There are 164 multi-campus governing boards, governing 886 institutions, but enrolling approximately one half of all full-time equivalent students enrolled in the collegiate sector.

TABLE II-13

GOVERNING BOARDS AND INSTITUTIONS GOVERNED, BY CONTROL

Characteristic	Number of Boards	Number of Institutions Governed	Total FTE Enrollment* (Fall 1974)
Total Governing Boards	**2,314**	**3,036**	**7,886,565**
Single-campus	2,150	2,150	3,722,509
Multicampus			
Governing 2-3 institutions	92	222	1,121,559
Governing 4 or more institutions	72	664	3,042,497
Public	**770**	**1,448**	**5,994,876**
Single-campus	632	632	2,002,720
Multicampus			
Governing 2-3 institutions	71	176	1,018,098
Governing 4 or more institutions	67	640	2,974,058
Private	**1,544**	**1,588**	**1,891,689**
Single-campus	1,518	1,518	1,719,789
Multicampus			
Governing 2-3 institutions	21	46	103,461
Governing 4 or more institutions	5	24	68,439

*FTE enrollment is full-time-equivalent enrollment.
Gomberg and Atelsek.

In the public sector, there are 770 governing boards, 632 single campus and 138 multi-campus boards. While there are more single campus public institutions, over two thirds of the students enrolled in the public sector are enrolled in institutions governed by multi-campus governing boards. Note the private sector has the preponderance of single campus governing boards, over 1,500. There are also multi-campus boards for private institutions — 26 boards which govern 70 institutions.

The implication of the structure of the governing board is most important and has been determined to be important relative to certain findings of this study. The multi-campus governing boards, particularly the public sector, multi-campus boards, have generally been included as a state-level focus with respect to NCHEMS product development. We submit, however, that the multi-campus governing boards, which are the legal and fudiciary agents of the institutions which they govern, are more appropriately considered institutional in perspective as opposed to state-wide in perspective. This distinction will be reviewed relative to the findings of the study.

In addition to the institutional governing boards, each state has now formed a super coordinating/governing board responsible for some aspects of coordinating or governing some or all aspects of postsecondary education. These coordinating/governing boards were formed in response to the requirements of the Educational Amendments of 1972 requiring states to designate a board or agency responsible for coordinating postsecondary education activities within the state (Millard). The state-wide coordinating/governing boards often utilize three planning and management functions to realize their objectives:

- Program approval (and program review);
- Planning; and
- Budget approval.

Because these planning and management tasks are related to the planning and management tasks of institutions, their impact should be considered in developing information requirements and planning and management tools for institutions.

CHAPTER III

USERS OF NCHEMS PRODUCTS/CONCEPTS

A. INTRODUCTION

How does one assess the impact of NCHEMS products? Does one look solely at the number of products which have been used, or does one investigate the degree to which the concepts incorporated in the products have been utilized in practice? Indeed, if one were to extend the concept argument to its logical conclusion, then the technical quality of the products becomes less important, while the degree to which product users understand the concepts becomes more important. The impact of NCHEMS products should be assessed by the degree to which the concepts incorporated into the products have been utilized and accepted in practice. The dissemination activities of NCHEMS involve disseminating concepts. The products are tools to facilitate that dissemination. Product utilization information alone is quite limited with respect to assessing the impact of NCHEMS products to improve the planning and management of postsecondary educational institutions.

The concepts incorporated in NCHEMS products are the classical concepts of analytic approaches to management:

- Definition of problems;
- Understanding interrelationships of external factors;
- Understanding interrelationships of internal units and the dynamics of the organization; and
- Generation of alternatives for consideration by the decision-makers (Hammond; Cox; Balderson; March and Olsen).

Those who have studied the use of quantitative tools have found that, even if the tools are technically inadequate for their intended purpose, the decision-makers who have had the experience in utilizing these tools still undergo a change in attitudes, assumptions, and emphases on their part with respect to decision-making problems (Cox; Plourde; Schultz and Slevin). Therefore, the impact of NCHEMS products should be assessed on the basis of the dissemination of concepts and the change in attitudes, assumptions, and emphases on the part of the decision-makers.

NCHEMS has espoused an informal dissemination strategy during most of the 1970's. During 1977 however, the NCHEMS Board of Directors has assisted the NCHEMS staff in developing a more formal dissemination strategy. While the formal strategy is recent, many of the concepts included in the strategy have been utilized by the NCHEMS staff during most of their previous work. The basic stages of the strategy are presented in Figure III-1, adapted from Rogers. The initial stage is awareness of the product and the concepts, followed by increased interest in both product and concepts. The next stage consists of an evaluation of the appropriateness of the available product (and its incorporated concepts) for the organization and decisions that have to

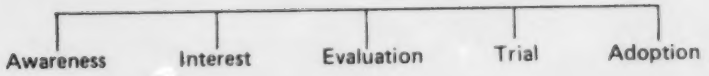


FIGURE III-1 COMPONENTS OF DISSEMINATION STRATEGY
NATIONAL CENTER FOR HIGHER EDUCATION MANAGEMENT SYSTEMS

be addressed. A trial usage of the product follows, including adaptation of the product to institutional data or using a test data set. Finally there is adoption which may include:

- Rejection of the product and concept;
- Rejection of the product but acceptance of the concept; or
- Acceptance of both the product and the concept.

We have investigated the dimensions of this dissemination strategy, from the point of view of NCHEMS, across these five stages, both for those organizations which are currently using NCHEMS tools and those organizations which may have used one or more of the tools in this study, but then may have discontinued their use. Furthermore, we have developed detailed information with respect to the current practice of adapting NCHEMS concepts and tools.

In this chapter we review the issues related to awareness of the products, interest in the products and concepts, and use of the products and concepts. In the next chapter, we have presented more detailed information with respect to the procedures for evaluating the products, their trial usage, and the degree and the form of their adoption for both current and discontinued users.

B. USE OF COMPUTER-BASED PLANNING TOOLS IN THE COLLEGIATE SECTOR

In this section we review the extent computer-based planning tools are being used in the collegiate sector. Figure III-2 identifies the extent of the use of computer-based analytic and planning tools in the collegiate sector of institutions and branches. Note that approximately 60% of these institutions and branches have used at least one computer-based planning tool. Twenty six percent of the collegiate sector have used one or more of the tools developed by NCHEMS and included in this study, and another approximately 30% have used tools other than NCHEMS, either developed by themselves or acquired externally. Of the NCHEMS users, approximately one-half used NCHEMS tools exclusively and the other half used NCHEMS tools in combination with other tools. This information was tabulated from a question which asked whether the institution had ever used one or more computer-based products. There was no indication of the depth of use. With that qualification, it appears that the use of computer-based analytical planning tools is extensive and has actually become an accepted practice.

Differences in the use of analytic planning tools by certain characteristic elements of the user institutions are evident. Figure III-3, which indicates the use of NCHEMS tools by type and control, shows that approximately one-half of the public universities and public four-year institutions has used one or more of the NCHEMS products, while substantially less than one half of the public two-year institutions has used one or more of the NCHEMS products. Private sector institutions use NCHEMS tools less than do public sector institutions. Two sectors are of particular concern — public two-year institutions and private four-year institutions. These two sectors comprise more than two-thirds of the total number of institutions in the collegiate sector and certainly have many of the management problems for which they need assistance in their planning activities (Baldridge et al.).

Perhaps the most important single independent variable which indicates a propensity to use computer-based analytical planning tools is organizational complexity, approximated by enrollment size. Figure III-4 shows those institutions (by percentage) which use computer-based planning tools (both NCHEMS and other tools) as a function of their enrollment size. A similar pattern for the use of all of NCHEMS products is also shown. Less than 10 percent of the collegiate sector institutions with enrollments under 2,000 students use one or more of the products included in this study. For institutions with enrollments greater than 20,000 students, there is a marked decrease in the use of NCHEMS tools, when compared with institutions with enrollment patterns between 10,000 and 20,000 students. For institutions with enrollment patterns between 2,000 and 10,000, there tends to be an increasing rate in the use of NCHEMS tools. However, there is a marked difference in the utilization pattern of institutions that use computer-based planning tools — either those developed by the institutions or those acquired externally. Figure III-4 also shows that increase in the use of such tools correlates with enrollment increases. Note that there is a significant difference in the utilization pattern of quantitative tools for institutions, with enrollment patterns higher than 20,000 students. With NCHEMS tools there is a decrease in usage. With non-NCHEMS users, there is a marked increase in use of computer-based planning tools for institutions with enrollments above 20,000 students.

Next we analyze the utilization pattern of computer-based tools other than those developed by NCHEMS. Figure III-5 indicates the sources of development. Note that the most important sources of the development of other computer-based planning tools are those developed by institutions themselves. Also note the significant increase in the propensity to develop their own computer-based planning tools for collegiate institutions with enrollment patterns above 20,000. The patterns are approximately the same for those institutions which either use tools developed by themselves or acquired from other external sources, and those institutions which do not use NCHEMS tools, but acquire tools from other sources. The importance of this finding is the propensity of institutions with enrollment patterns greater than 20,000 students to develop their own computer-based planning tools.

From these utilization patterns, it appears that the propensity of an institution to utilize computer-based planning tools is a function of the organizational complexity, as approximated by enrollment. This principle appears to confirm the experience of those who have utilized planning tools in a variety of environments. Complex organizations, particularly organizations for which it would be very difficult for a small decision-making body to fully comprehend their overall operations, appear to need computer-based planning tools more than organizations which operate in more simple or less complex environments. This principle is consistent with the findings of Cox et al. on the utilization of financial models in business organizations.

The utilization of computer-based planning tools is accepted in practice throughout American higher education by approximately one-half of the institutions in the collegiate sector. This group has used one or more computer-based planning tools. Approximately one quarter of the collegiate sector has ever used one or more of the NCHEMS products included in this study.

C. AWARENESS AND INTEREST IN NCHEMS PRODUCTS

The utilization patterns of NCHEMS products cited above are important, but they must be considered within a broader context. That broader context includes both awareness and interest in the products themselves and appreciation and utilization of the concepts incorporated in the products. We fully recognize that NCHEMS is not the only source of quantitative approaches to

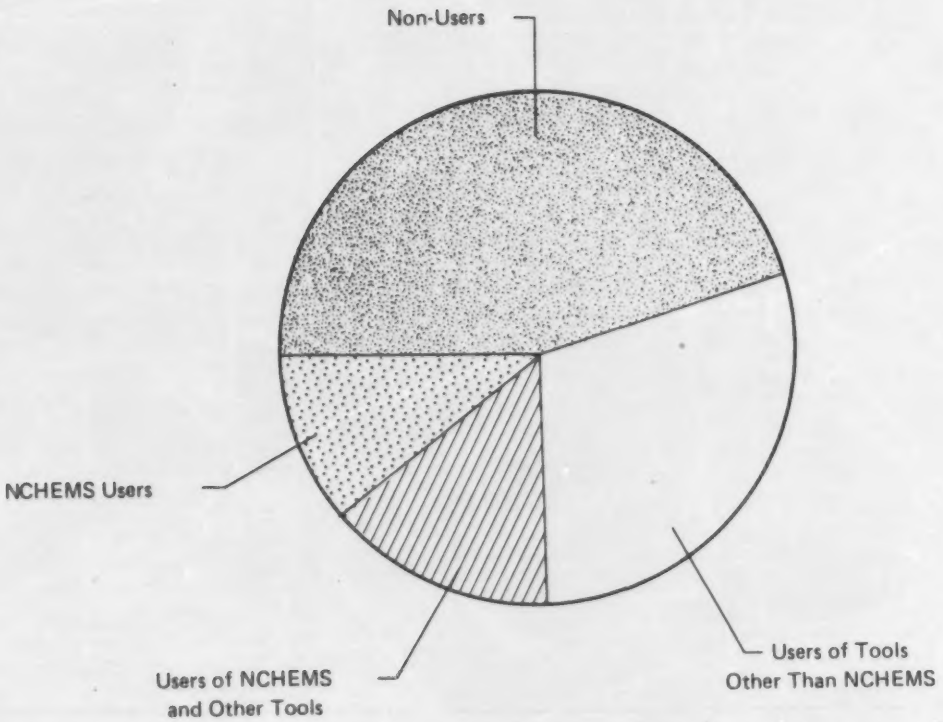


FIGURE III-2 EXTENT OF USE OF COMPUTER-BASED, ANALYTICAL PLANNING TOOLS COLLEGIATE SECTOR INSTITUTIONS AND BRANCHES (3,075)

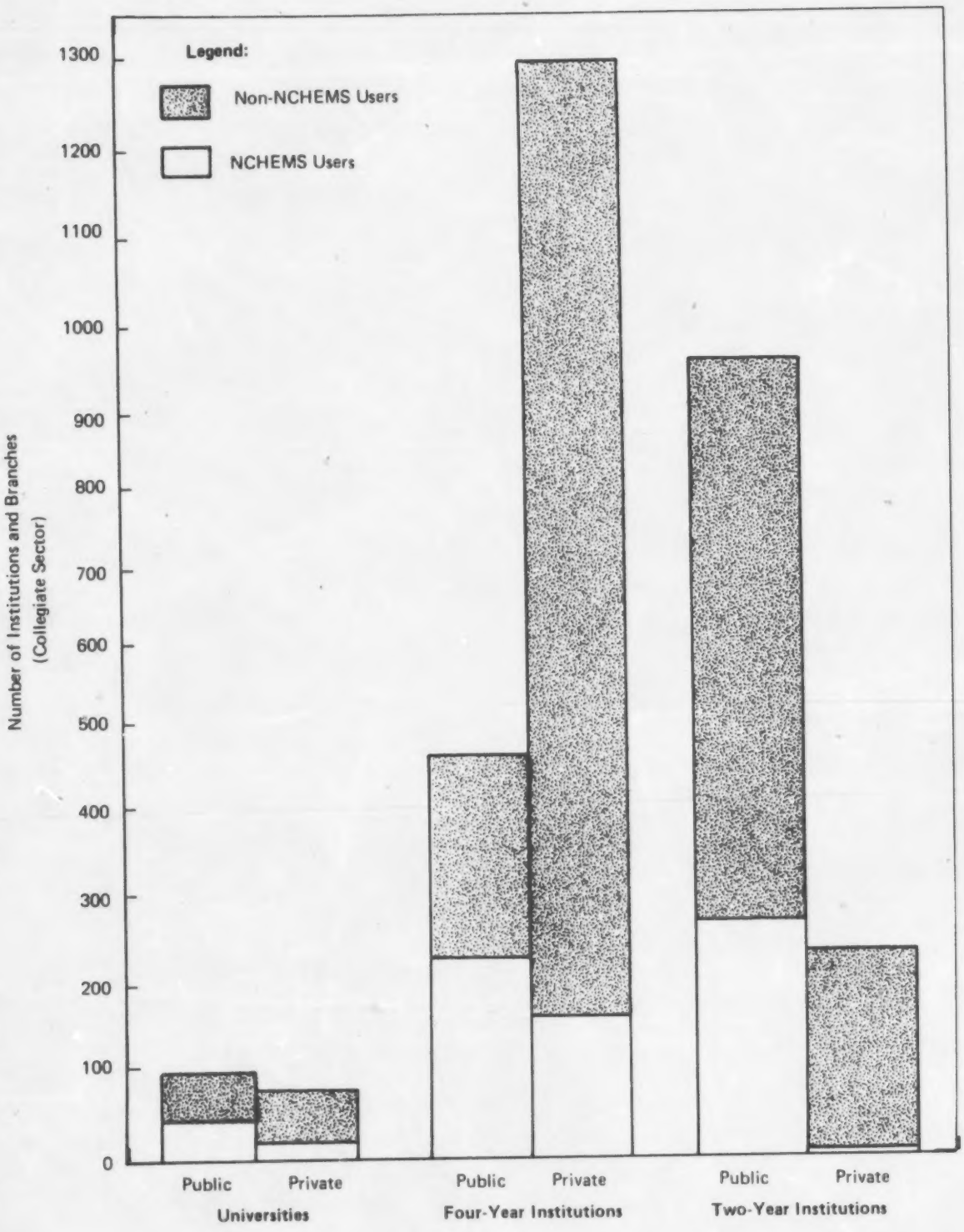
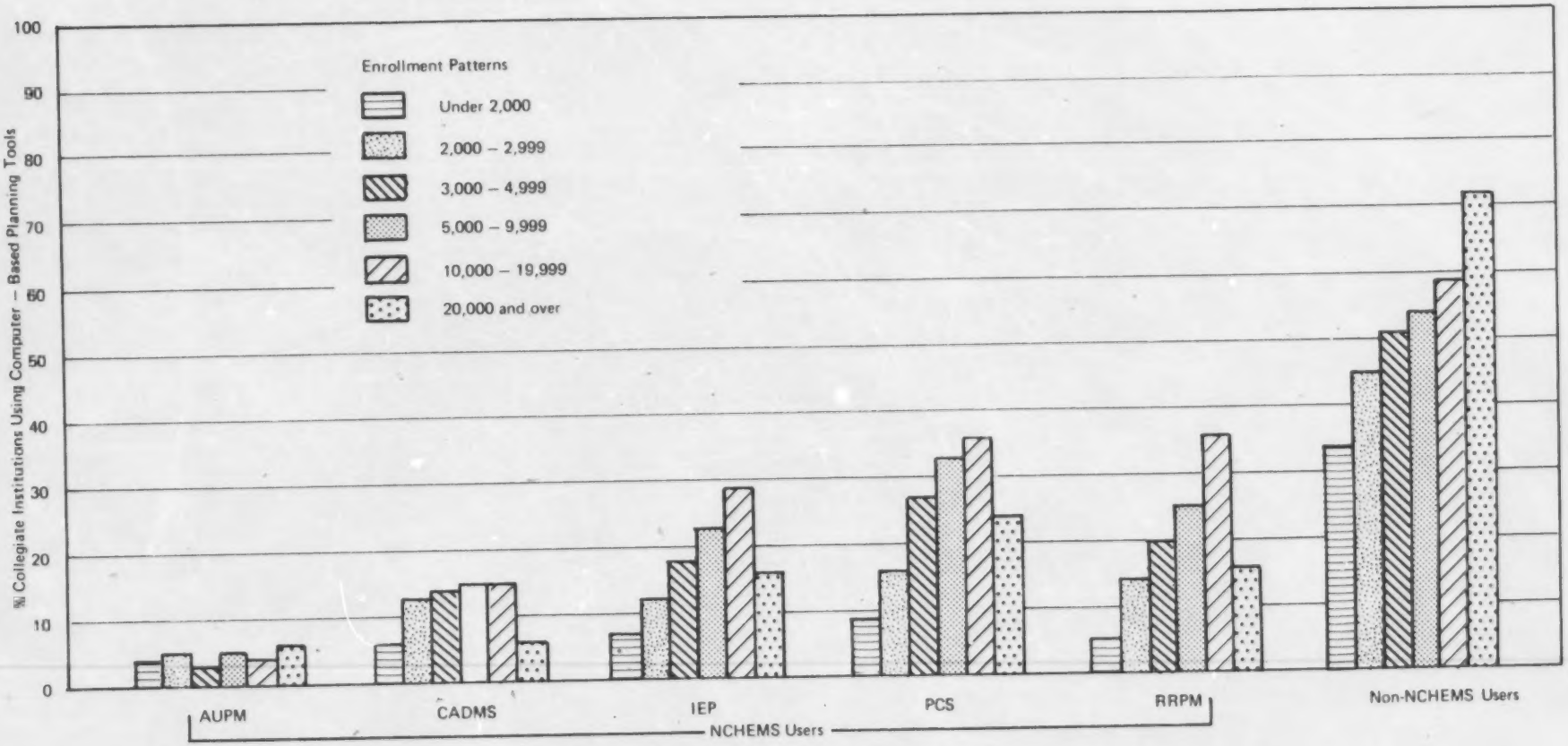


FIGURE III-3 NATIONAL CENTER FOR HIGHER EDUCATIONAL MANAGEMENT SYSTEMS COLLEGIATE SECTOR INSTITUTIONS AND BRANCHES (3,075) USERS OF ONE OR MORE OF THE NCHEMS PRODUCTS INCLUDED IN THIS STUDY



Percentage Base: Collegiate Sector Institutions and Branches Interviewed During Phase I Survey

FIGURE III–4 USERS OF COMPUTER – BASED PLANNING TOOLS AS A FUNCTION OF ENROLLMENT PATTERNS

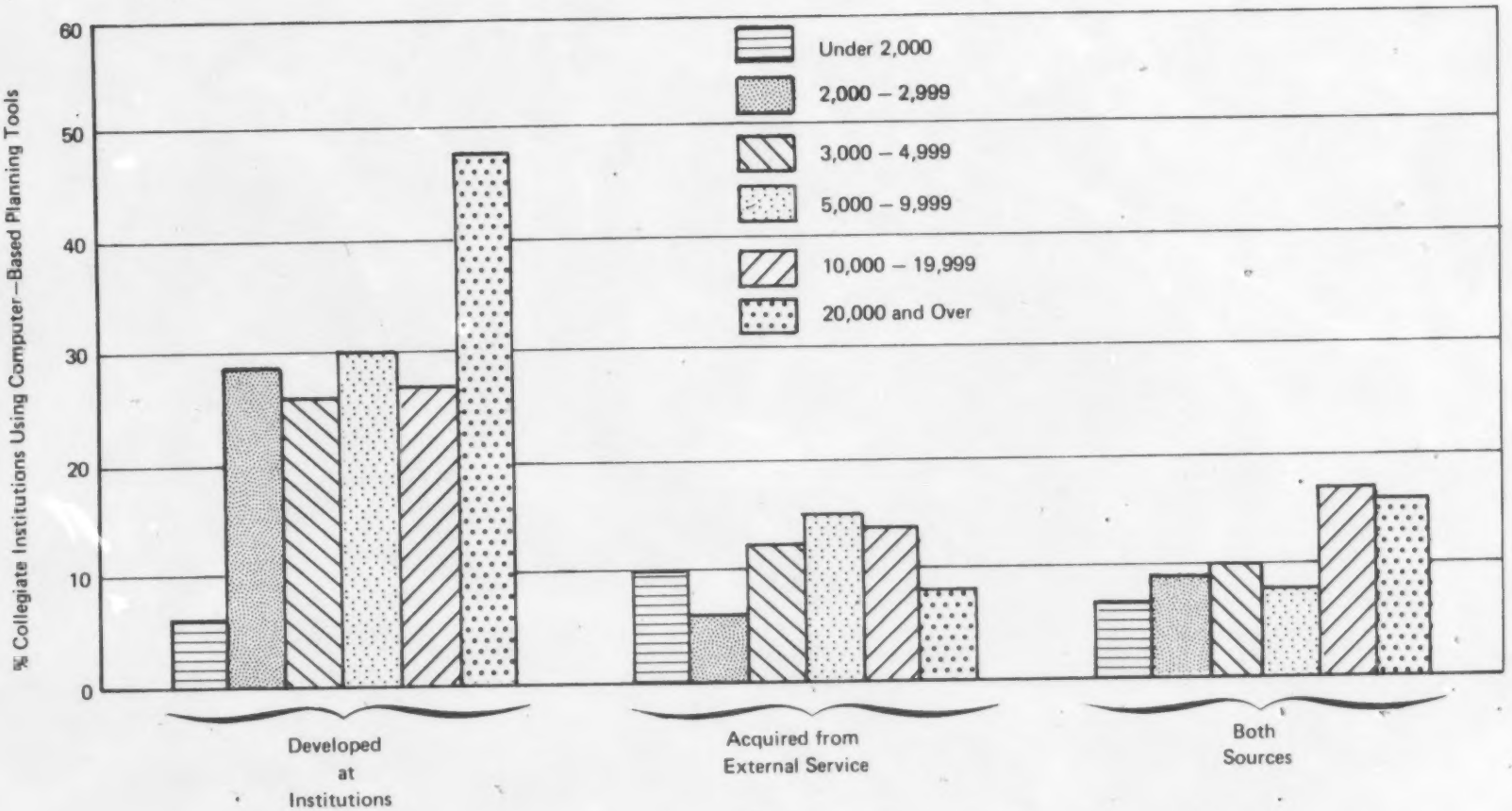


FIGURE III–5 SOURCES OF DEVELOPMENT OF COMPUTER BASED PLANNING TOOLS OTHER THAN NCHEMS TOOLS

management in postsecondary educational institutions. Undoubtedly, the research and dissemination activities of the Center over the last decade have had an important impact upon the recognition of the utilization of quantitative approaches to management in postsecondary education, and the pattern is similar to that which has been experienced by the corporate sector, as depicted in the Cox study of financial planning tools in business.

The attribution question is of concern to many individuals interested in this study. To what degree can the acceptance of quantitative approaches to planning and management be attributed to NCHEMS activities.[2] The attribution question appears to be less important than the degree to which these concepts are currently used in practice. The total amount of resources made available to NCHEMS is somewhat inconsequential when compared to the total amount of resources utilized by postsecondary education. Furthermore, NCHEMS tools are vehicles for the dissemination of concepts. Therefore, a proper assessment of product impact must recognize and appreciate the concepts included in the products. Technical considerations should only be deemed important on the basis of how much those technical factors affect concept awareness. In addition, it is possible to be aware of NCHEMS tools and concepts, evaluate the use of the tools, and reject the tools, but still utilize the concepts, either through development of tools specific to the institution or within a certain frame of reference for decision-making. In this section, we will review the patterns of awareness of NCHEMS tools and those factors which influence interest in NCHEMS tools. In the next section, we will review the degree to which the concepts incorporated in the tools are currently accepted in practice.

Approximately 50% of those in charge of the analytic function of collegiate sector institutions are product-specific *aware* of the five NCHEMS tools included in this study. The one difference of this general pattern is AUPM, for which only 39% of the administrators evidenced an awareness. These patterns are summarized in Figure III-6. There are significant differences with respect to the awareness of NCHEMS products as a function of the pattern of use of NCHEMS products. Even for those institutions which do not use NCHEMS tools or other computer-based tools, there is a product-specific awareness ranging from 27% for AUPM to a high of 40% for IEP. If institutions use tools other than NCHEMS, product-specific awareness increases to a low of SIZE 43.84 CLC 240 42% for AUPM to a high of 51% for IEP. Again, there is a significant increase in product-specific awareness for those institutions which have used one or more NCHEMS products, but not other analytic planning tools. For this group of institutions, product-specific awareness ranges from a low of 54% for AUPM to a high of 82% for PCS. Finally, those institutions which use NCHEMS products as well as other computer-based planning tools, NCHEMS product-specific awareness ranges from a low of 60% for AUPM to a high of 85% for PCS.

There is product-specific awareness of the five products included in this study throughout institutions in the collegiate sector. Product-specific awareness tends to increase with the use computer-based tools, including both NCHEMS and other tools. This pattern suggests a general theme about the use of computer-based tools, viz., that those who have a propensity to use NCHEMS as well as other tools tend to be more aware of computer-based tools, in general, than those who exclusively use either; 1) NCHEMS tools or 2) other tools exclusively (either developed by the institution or purchased externally).

The next stage after awareness in the dissemination strategy used for this study focuses on the potential *interest* in utilizing the tools and concepts. Each respondent in the Phase II study

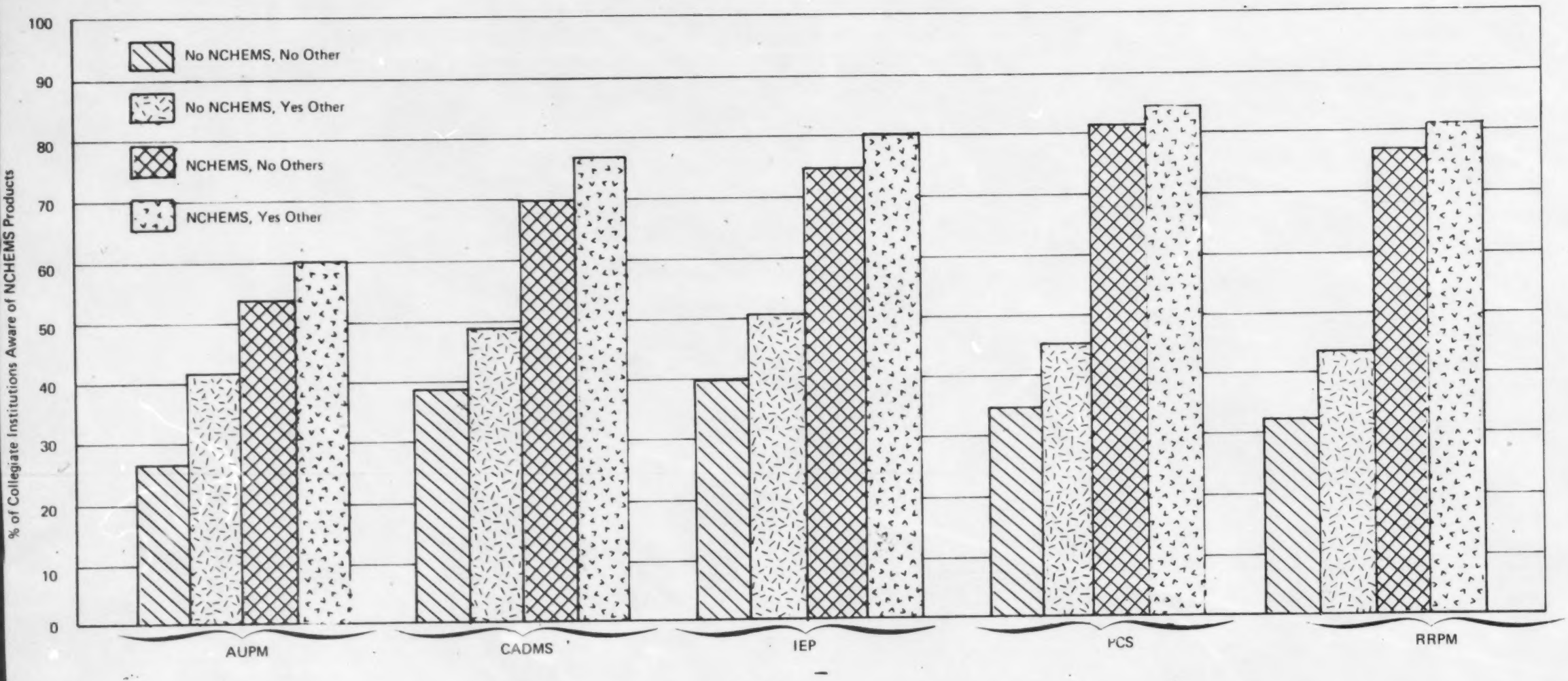


FIGURE III–6 COLLEGIATE SECTOR AWARENESS OF NCHEMS PRODUCTS

was asked to indicate to what extent the basic elements of NCHEMS dissemination strategy provided sources of information which influenced their knowledge and/or interest in NCHEMS products. Based upon a tabulation of these responses, we have divided the elements of the dissemination strategy into two groups: higher influence sources (greater than 50% importance) and lower influence sources (less than 50% importance). As indicated in Table III-1, the four higher influence sources are:

- User-oriented NCHEMS manual about the products;
- Technical NCHEMS manuals about the products;
- Formal papers and presentations by NCHEMS staff and/or members of the advisory structure representing NCHEMS; and
- NCHEMS training and dissemination seminars.

The weights of importance assigned to each of these higher influence sources are also represented in Table III-1.

Lower influence sources of information about NCHEMS products include:

- Case study documentation on results/benefits in using NCHEMS products;
- Published proceedings of meetings, seminars, and assemblies;
- Referrals from others who have used the products; and
- Other sources.

It was pointed out in a review of earlier findings of this study that there are only limited examples of case study documentation on results and benefits from utilizing NCHEMS products. This lack of availability may have influenced the low rating on case study documentation. In reviewing the finding of the low importance assigned to client references, it was noted that this finding differs from the expected role of "opinion leaders" in the diffusion literature (Rogers).

Respondents to the Phase II survey were asked to indicate the one most important professional or institutional membership association which influenced the development of their managerial philosophies. From these responses, it seems that professional associations influence the development of an individual's managerial philosophies, including the importance associated with the utilization of analytical tools as an important management concept in performing a professional role as an administrator. Then they were asked to what extent they believed that members of this association which most influenced their managerial philosophies accepted the use of analytical tools as an important management concept in performing their professional role. Forty-nine percent indicated that, to a great extent, the members of the association they selected previously accepted the use of computer-based planning tools. An additional 34% indicated the members of the association they selected used them to some extent, while only 12% indicated very little or to no extent. Dissemination of the concepts incorporated in NCHEMS tools in soliciting interest in the utilization of both tools and concepts appears to be facilitiated by interaction with professional associations most directly related to or involved in a particular product or concept.

TABLE III-1

INFLUENCE OF SOURCES OF INFORMATION
ON KNOWLEDGE OF NCHEMS PRODUCTS

	Great or Some Extent	Little or No Extent	No Opinion
Higher Influence			
User-oriented (overview) NCHEMS manuals about the products	74%	22%	4%
Technical NCHEMS manuals about the products	69%	37%	4%
Formal papers and presentations by NCHEMS staff and/or members of advisory structure representing NCHEMS	64%	32%	4%
NCHEMS training and dissemination seminars	58%	37%	4%
Lower Influence Sources			
Case study documentation on results/benefits/problems in using NCHEMS products	38	58	4
Published proceeding of meetings, seminars, and assemblies	37	59	
Referrals from others who have used the products	33	62	5
Other sources	21	19	60
Respondent Base: 302 of 440 Respondents			

D. UTILIZATION OF THE CONCEPTS INCORPORATED IN NCHEMS PRODUCTS

1. Introduction to Concept Awareness

In this section we review our conceptual model for assessing the utilization of concepts incorporated in NCHEMS products and empirical evidence collected during the Phase I and II studies. A unifying theme among the five NCHEMS products in this study is a focus on information, particularly quantitative information, about cost, resources, outcomes, and their use in planning and management functions. This theme assumes that decision-makers in post-secondary educational institutions are "rational actors" taking actions to optimize their institutions' best interest. Implicitly, it is assumed that a decision-maker has the same objectives as the institution and that the analytic function (those individuals responsible for managing the analysis activities of an institution) will be so close to that of the decision-makers themselves that the decision-makers will adopt the course of action recommended by such analysis.

Rationality is a major assumption underlying qualitative management tools and is often defined in an external, universal sense rather than in the decision-makers' own terms and experiences (Hammond; March and Olsen; and Allison).

Empirical evidence on how decisions are made indicates that this seldom ever happens (March and Olsen). Many who have studied the policy formation and decision-making processes of educational institutions and other non-profit institutions have suggested that the asssumptions of rationality need to be modified to accommodate values and other influences which affect the decision-making processes of the decision-making bodies (Bauer and Gergen; Corwin; Baldridge et al.; Balderston; Hammond; Fielden and Lockwood; Mason; Glenny et al.; Parsons and Platt; Peterson; Moodie and Eustace; van der Berghe; Schmidtlein; Steinbruner; March and Olsen).

Many reasons have been suggested for the divergence between the normative theory of rationality and the empirical evidence of how decisions are made. Churchman and others have pointed out that part of the problem is that decision-makers' goals and individual goals are often different from organizational goals. The divergence of goals may result in an institution's reward and incentive system inducing behavior different from what the organization intends (Churchman). Specialization and functional division of labor may result in subunits of the institution having different and sometimes incongruent subgoals when compared with the overall goals of the organization (Lawrence and Lorsch; Cyert and March; Likert and Likert). Constituents may have values, beliefs, and common goals different from those of other constituents in an institution. These differences may lead to high levels of conflict over institutional goals and decision-making prerogatives for achieving those goals (Baldridge; Gross and Grambsch; Peterson and Uhl).

For institutions governed by multi-institution governing boards, institutional aspirations and goals may be quite different from the goals expected of the institution within the framework of the system's master plan (Berdahl; and Glenny and Weathersby). From the individual faculty member perspective, there is often a discrepancy between the institutions' overall goals and the faculty members' professional goals. The faculty member's professional goals are often more related to his or her discipline in terms of publishing, research, and decisions of tenure than in the realization of institutional goals. This discrepancy between an individual's professional goals and institutional goals is common in professional organizations in general (Moore) and educational institutions in particular (Baldridge).

Analytical tools often address only quantitatively part of a decision problem, instead of analyzing the whole management problem (Wagner). Therefore, the decision-making bodies must blend the results of their analyses with considerations not covered, partially covered, or covered with some distortion in the analyses. In fact, this combination is effecting a congruence in management science thinking relative to normative decision theory on how decisions "ought to be made" versus descriptive decision theory of how decisions are "actually made" (Bauer; Paine and Naumes; and Rodgers). Consequently, for the purposes of this study, we investigated how decision-makers in educational institutions actually make decisions and the influence of information produced by NCHEMS products.

2. Conceptual Framework for Concept Awareness

A conceptual framework for concept awareness was utilized in this investigation which permits assessing the degree to which analytical information is integrated with other influences on decision-makers. This conceptual framework relies on the model of human thought processes adapted from the works of those who have studied human reasoning over the past few decades, and those who have more recently applied this line of thinking to decision problems (Simon and Newell; Bruner, Goodnow, and Austin; McKenney; Keen; Bauer and Gergen; and Steinbruner). These concepts should be familiar to those who read the modern literature on organization theory. The resulting conceptual scheme, as adapted from Hammond, is presented in Figure III-7.

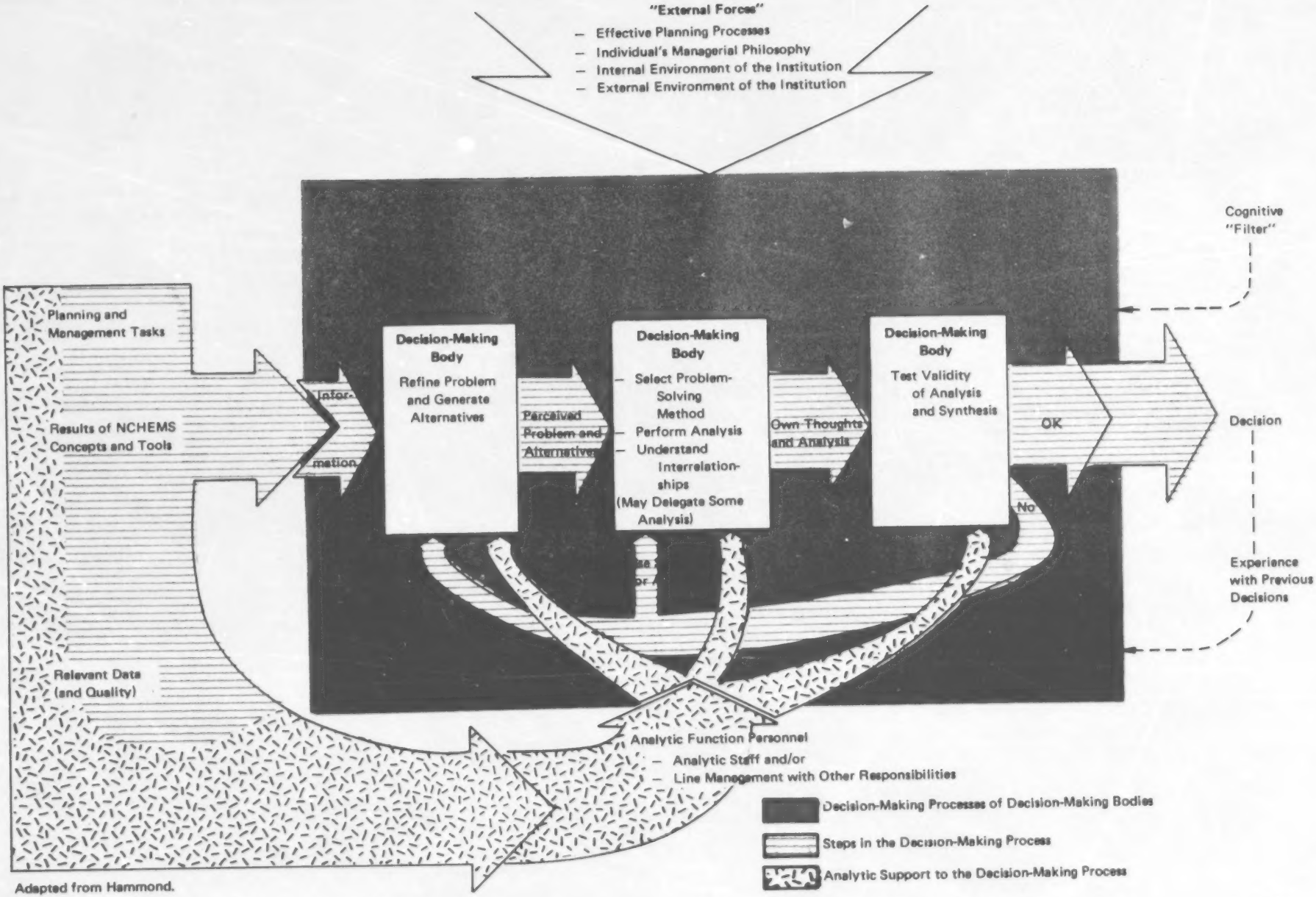
First, we will consider a brief overview of the conceptual model, and then we will relate the findings of the study to implications for assessing the impact of NCHEMS products. There are many factors and forces which affect the decision-making processes of interest in this study. The decision-making body may be one individual, or a group of individuals, responsible for the planning and management decisions for the institution or the academic unit. There are many external forces (that is, external to the decision-making body) which impinge upon the decision-makers' resolution of the decision problem. These forces not only affect the decision-makers' perception of the problem, but can also directly affect the manner in which the decision-makers respond to making decisions and the influence of information derived from NCHEMS products (Brown).

Second, the nature and characteristics of the decision problems themselves and relevant data regarding the decision (such as data derived from the NCHEMS products) affect the resolution of the problem. Decision problems may vary according to their complexity; the degree of structure inherent in them; the value and importance of the decision problem to the decision-making body, and its organization, and time pressures; the interests of the various constituent groups in a particular problem; and the influence of the decision-makers' organizational position (Anthony; Simon and Newell; Bower; and Baldridge).

Finally, there are the influences of the analyses derived from the NCHEMS products and the analytical function available to support the decision-making body. Note in Figure III-7 that data may be directly available to the decision-making body, or they may be provided to the decision-makers via the analytic function.

What are the decision-making bodies' thought processes that are involved in reaching a decision (see Figure III-7)? These normally consist of:

- Recognition of the importance of data in decision-making;
- Defining the problem;
- Understanding relationships with forces outside the institution and changes in these relationships;
- Understanding the interdependence of various units of the institution;
- Generating alternatives for consideration by decision-makers; and
- Synthesizing the result of various analyses and testing its validity.



Adapted from Hammond.

FIGURE III–7 FACTORS AFFECTING THE DECISION-MAKING PROCESSES AND THE USE OF NCHEMS PRODUCTS

This is a dynamic and iterative process consisting of several feed' ack loops. At any step in the process, the decision-making body may loop back to another step, if inadequacies are discovered in the results of the earlier steps. At any point, the decision-making body can also gather additional information either on its own or through the analytic function. It is important to emphasize that the decision-making body may consider these steps in either a conscious or subconscious manner. In the latter case, the decision-making body often little understands its decision-making processes, and reaches a decision in a manner which is often not consciously known to them. We believe that this conceptual approach assists us in better understanding how and why NCHEMS products affect the planning and management functions of postsecondary educational institutions.

A number of other relevant aspects of the human cognitive process that would affect the activities of the decision-making body are presented in Figure III-7. They include:

- the cognitive filter (the attention-focusing mechanism surrounding thought processes);
- experience with previous decisions;
- perceived problems and alternatives; and
- the thoughts and analyses of the decision-making body.

Other cognitive processes also influence the decision-making processes, such as the fact that the human memory is an associative one, the process of the concept formation, the role of cuing, the role of mental set, and the finite information processing capability of the human mind. They are reviewed by Hammond and Steinbruner. With this conceptual model as a background, we will review the findings of the study and their implications to the NCHEMS dissemination strategy.

3. Role of Analytic Function

Decision-making bodies may delegate aspects of their decision-making process, particularly data gathering and analytic efforts to an analytic function. For purposes of this study, we have expanded the concept of an analytic staff, which may include such positions as planning officer, institutional research staff, or data processing personnel to a much broader concept of analytic function. This analytic function is responsible for collecting data and analyzing data with respect to the decision-making problem of an institution. The function may be performed by a staff officer or a line officer who has other management responsibilities. Of the NCHEMS users, in 47% of the institutions the person responsible for the analytic function is a person with management responsibilities and other management functions. Of the other 53% of the institutions, 7% have a single person assigned to perform the analytic function, 38% have a staff of two or more, and 8% have no one assigned the responsibility.

Of the 38% of the NCHEMS users who have an analytic staff of one or more, the following breakdown was identified:

- 2% have an analytic staff of one professionals;
- 8% have an analytic staff of two professionals;
- 12% have a staff of three professionals;
- 5% have a staff of four professionals; and
- 11% have a staff of five or more professionals.

Note that the above percentages are for the entire NCHEMS user institutions. The implications are that there are relatively few institutions, 11% of the total NCHEMS users group, which have a staff of five or more professionals exclusively performing the analytic function.

Table III-2, taken from the U.S. Office of Education General Directory for 1976-77, summarizes the total number of collegiate institutions and branches which reported positions of chief planning officer, director of computer center, and director of institutional studies. Table III-2 gives a percentage of institutions reporting such positions for the total collegiate sector as well as for four-year and senior institutions, and two-year institutions. Note that 17% of total institutions have chief planning officers of which 13% are in four-year and senior institutions and 4% are in two-year institutions. Similarly, 30% of the collegiate sector institutions have a director of computer centers, with 21% in four-year and above and 9% in two-year and above institutions. Director of institutional studies are represented in 16% of institutions with 12% in four-year and 4% in two-year institutions. We have not attempted here, through secondary data, to establish a correlation with analytic staff and the use of computer-based planning tools. We have identified the availability of analytic staff within collegiate sector institutions. On the other hand, the NCHEMS user population of institutions has an analytic staff more often than the collegiate sector as a whole.

TABLE III-2

ANALYTIC STAFFING IN INSTITUTIONS OF HIGHER EDUCATION AND BRANCHES, AGGREGATE UNITED STATES, 1976-77

	Collegiate Sector		
	Total	4-Year	2-Year
Chief Planning Officer – The principal administrative official responsible for the direction of planning activities. Functions supervised typically include facilities planning, budget planning, institutional studies, and related activities.	17%	13%	4%
Director, Computer Center – Directs the institution's major computing activities. Functions typically include computer programming, systems studies, and computer operations.	30%	21%	9%
Director, Institutional Studies – The administrative staff official responsible for the conduct of research and studies on the institution itself. Functions performed or supervised typically include data collections, analysis, reporting, and related staff work in support of decision-making.	16%	12%	4%

Sources: National Center for Education Statistics.
Education Directory: Colleges and Universities 1976-77.
Washington, D.C. & U.S. Government Printing Office, 1977.

4. Quality of Data Available for Decision-Making

Next in our conceptual framework we review the availability of data and the assessment of the quality of data available for decision-making. First we want to review the availability of mechanized data. Educational institutions are experiencing an increase in their external reporting requirements and needs for data for internal management purposes. This need has facilitated and encouraged the shift to automation from manual procedures. Table III-3 indicates the percent of NCHEMS users which have automated the six major data base areas of their institutions, and the degree to which the data base areas have been automated. The table shows that facilities and miscellaneous data bases have the greatest tendency to be manual systems, while student records, personnel, and financial records tend to be automated. The curriculum data base, which is necessary to support registration activities, tends to be both automated and manual, while many colleges still have manual systems only. It is interesting to note that those institutions which are using computer facilities are currently using batch processing capabilities to a greater extent than on-line processing capabilities. In summary, NCHEMS user institutions tend to have automated records. This has important implications with respect to the future strategies of NCHEMS, given the ever decreasing cost of computing capabilities and the likelihood that more institutions will shift in the future to automated capabilities for their operational functions (Rodgers and Traicoff).

TABLE III-3

LEVEL OF AUTOMATION INSTITUTIONS WHICH USE NCHEMS PRODUCTS

	Manual System Only	Bookkeeping Machine	Ledger Accntg. Machine	Tabulation Equipment	Computer	
					Batch Processing	On-Line Processing
Students (including admissions, testing and counseling, registration and alumni)	5%	0	0	0	63	27
Curriculum (such as classes, tutorials, laboratories, off-campus activities)	20%	0	0	3	55	16
Personnel/Payroll (includes both faculty and staff)	3%	1	3	0	73	15
Financial (includes purchasing and disbursements, budget, general ledger, income, student accounting, financial aid and billing)	6%	5	8	2	58	16
Facilities (physical plant, space utilization and equipment)	45%	2	0	1	44	4
Miscellaneous (bookstore, library cataloguing, circulation, etc.)	53%	1	5	7	20	7

We assessed the effectiveness of data processing support by asking individuals to assess the quality of data available for decision-making. This assessment is completely independent of the mechanisms which the institution utilizes in manipulating its data. It is entirely possible that some institutions can have high-quality information without having automated procedures. Presumably the quality of data available for decision-making would have some influence upon the degree to which decision-makers would rely upon internal data sources.

Table III-4 presents the results of the assessment of the quality of data available for decision-making by decision-makers at institutions which utilize NCHEMS products. Some 25% of the decision-makers strongly agree that data available to decision-makers are easily understood. Twenty-eight percent of the decision-makers believe that they can rely upon the data available at their institutions, while 15% believe that the data available to decision-makers release work pressure upon them. Only 15% agree the data are readily available when needed, and 5% believe that there are too much data available. Note that 33% strongly disagree that there are too much data. With the exception of the issue of too much data, the "mildly agree" pattern is somewhat similar for each of the other four dimensions of the quality of data.

TABLE III-4

ASSESSMENT OF THE QUALITY OF DATA AVAILABLE TO DECISION-MAKERS

USERS OF NCHEMS PRODUCTS

	Agree Strongly	Agree Mildly	Disagree Mildly	Disagree Strongly	No Response
Data available for decision-makers are easy to understand	25%	55	18	2	*
You can rely on the data available in your institution	28%	53	15	4	*
Data made available to decision-makers release work pressure	15%	49	27	5	4
Data are readily available when needed for decision-making	15%	45	32	8	*
There are too much data available	5%	18	43	33	1
440 Respondents; NCHEMS Users					

*Less than 1%.

There are some significant differences within these trends with respect to the independent variables identified for this study. Institutions which are governed by systems offices tend to believe that data are more easily understood than multi-campus institutions or individually governed institutions. Institutions which have established effective planning processes tend to rate higher the quality of data available for decision-making than institutions with lower scores on the effective planning processes; the types of respondent (institutional management, academic management, or analytic function) tend to agree on their assessments of the quality of data made available for decision-making.

5. Characteristics of the Decision-Making Processes at NCHEMS User Institutions

Now let us turn to an assessment of the extent to which certain factors affect the thought processes of decision-makers in reaching a decision. These data are taken from 440 respondents at 126 NCHEMS user institutions, and are summarized in Table III-5. The respondents were asked to characterize the decision-making processes at their institutions and to state to what degree certain benefits are derived from the decision-making processes. Some 93% of the respondents said that their institutions have benefited by recognition of the importance of data in decision-making to at least some extent. Some 79% of the respondents agreed to either a "great" or "some extent" that the decision-making processes improve the ability to better define problems. Some 82% agreed, to either a "great" or "some extent" that the decision-making processes recognize the importance of understanding relationships with forces outside the institution and changes with those relationships, and 81% believe that decision-makers in their institutions have a better understanding of the independence of the various units of the institution.

TABLE III-5

DECISION-MAKERS THOUGHT PROCESSES IN REACHING A DECISION

NCHEMS USERS

	Great Extent	Some Extent	Very Little	No Extent	No Opinion
Recognition of the importance of *data* in decision-making	50%	43	6	1	*
Ability to better define problems	24%	55	17	2	2
Importance of understanding relationships with forces outside the institution and changes in these relationships	38%	44	14	2	2
Better understanding of inter-dependence of various units of the institution	27%	54	17	1	1
Generation of alternatives for evaluation by decision-makers	17%	55	23	2	3
440 Respondents; 126 Institutions					

*Less than 1%.

The thought processes described above do not require a choice. These are the preliminary steps leading to a complete cycle of choice. However, 72% of the respondents believe that their decision-making processes generate alternatives for evaluation by decision-makers. It is important to note that among the 72% only 17% agree to a "great extent" that alternatives are generated for evaluation by decision-makers. The implication of this pattern is important. The analytical approaches to management with respect to how decisions are reached appear to be

accepted in practice. However, there are other influences which affect the complete cycle of choice. It is important to recognize the important role being played in the acceptance and practice of the quantitative approaches to management which, in reality, are tempered by other influences upon the decision-making processes in educational institutions. These thought processes influence the impact of information derived from NCHEMS products with respect to decision-making.

There are some significant differences within the above pattern of decision-makers' thought processes in reaching a decision with respect to the independent variables used in this study. We will review each of the six factors that affect decision-makers thought processes with respect to the significant differences for each independent variable. First, let us consider the *recognition of the importance of data in decision-making*. There are differences with respect to enrollment patterns, belief in the role of professional managers, institutional planning processes, and quality data for decision-making. Institutions with enrollments of under 2,000 students tend to have a higher recognition of the importance of data in decision-making than do institutions with enrollment patterns between 2,000 and 20,000 and over 20,000. Decision-makers who have a stronger belief that professional managers should be balanced with an educational experience have a higher belief in the recognition of the importance of data than those who believe that professional managers can manage educational institutions without a significant academic experience. The highest divergence with respect to the recognition of the importance of data in decision-making results from institutions with a stronger planning process. Some 74% of the respondents from institutions which are characterized as having effective planning processes agree "to a great extent" in the recognition of the importance of data in decision-making, while only 28% of decision-makers from institutions with a low rating of effective planning processes do likewise. The quality of data available for decision-making strongly influences the recognition of the importance of data.

Next we consider the *ability to define problems*. Institutions with enrollment patterns under 2,000 students stress the ability to better define their problems to a greater extent than do larger institutions. Likewise, institutions with effective institutional planning processes and a high score on the quality data are more likely to stress their own ability to better define problems. The strength of the institutional planning processes tends to be the major influence upon differences with respect to an institution's ability to better understand interrelationships, both between forces external to the institution and between the various units within the institution.

Finally, with respect to the ability to *generate alternatives for evaluation by decision-makers*, there are two significant differences. Decision-makers, both institutional and academic management persons, believe that the decision-making processes of their institutions benefit more from the generation of alternatives for evaluation by decision-makers than do the analytic function persons. Since the decision-makers are the ones responsible for making decisions, this is an important distinction. There is a slight underestimation of the perceived recognition of the importance of quantitative approaches to an institution by those performing analytic functions. It is our understanding that this represents a different trend from that generally recognized by those who advocate quantitative approaches to management. That is, the advocates perceive that the analytic function person better understands and appreciates the benefits of their techniques and approaches than do the decision-makers who actually use them (Weathersby). While the differences may be modest, it is important to recognize this distinction. By far the most influential independent variable with respect to the generation of alternatives for evaluation by

decision-makers is the effectiveness of the institutional planning process. Institutions which have effective planning processes tend to emphasize the generation of alternatives for evaluation by decision-makers. These differences appear to be greater than the quality of data and the differences across the use of specific quantitative tools. This factor suggests that the impact of NCHEMS products is more a function of the organizational planning processes than the technical quality of the products themselves. This finding corroborates the position of Schultz and Slevin, as well as the conceptual approach used in this study. It is also important to note that factors external to the decision-making body have greater influences upon the completion of the cycle of choice than do factors within the decision-making body.

6. Relative Influences on Organizational Choice

Factors external to decision-making bodies influence the realization of a complete cycle or organizational choice. The final step in the cycle of organizational choice is synthesis of results of analyses and previous experiences and the actual reaching of a decision. A complete cycle of choice assumes a closed cycle of choice with respect to:

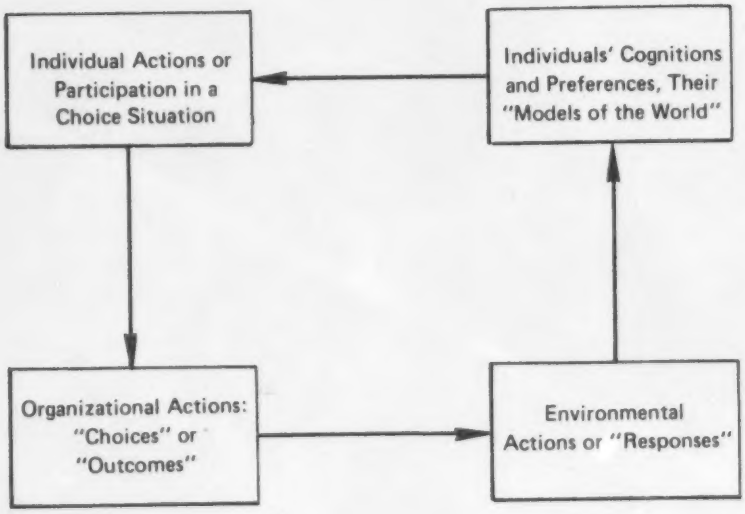
- cognitions and preferences held by individuals that affect their behavior;
- the behavior (including participation) of individuals that affects organizational choices;
- organizational choices that affect environmental acts (or responses); and
- environmental acts that affect individual cognitions and preferences.

An illustration of this complete cycle of organizational choice is presented in Figure III-8, adopted from March and Olsen. These basic ideas are fundamental to much of the understanding of choice decisions in organizations, and serve to amplify the conceptual framework adapted from Hammond. March and Olsen have suggested that, because the complete cycle of choice in organizations varies significantly from empirical evidence that, there are certain modifications which need to be made, based upon empirical evidence (Bower). Modifications are required because the basic cycle of choice may be interrupted or changed so significantly that they could modify the implications of the "rational assumptions" of decision-making (Steinbruner). Such occurrences include:

- Attention to an organizational problem does not precisely control organizational behavior;
- Participation in the choice process is not a stable consequence of properties of a choice situation or individual preferences;
- Outcomes of a decision-making process are not always direct consequences of that process;
- Environmental response is not always attributable to organizational action;
- Belief is not always a result of experience (March and Olsen).

Many of these same characteristics have been identified by others who have studied the policy formation processes of educational institutions (Baldridge) and other non-profit institutions (Bauer and Gergin).

THE COMPLETE CYCLE OF CHOICE


Individual Actions or Participation in a Choice Situation
Individuals' Cognitions and Preferences, Their "Models of the World"
Organizational Actions: "Choices" or "Outcomes"
Environmental Actions or "Responses"

Source: March and Olsen.

FIGURE III-8 THE COMPLETE CYCLE OF CHOICE

The cycle of choice is frequently influenced by *exogenous factors* that are beyond the control of participants internal to the institutions. It must be recognized that the decision-making processes of educational institutions are deeply imbedded in larger decision processes, and that any attempt to understand the process of an individual institution without acknowledging or attempting to understand the broader context is likely to be a futile effort. Any one of the connections of the internal decision-making processes to the external factors may result in such an overwhelming force that the direction of the internal decision process is completely overridden. External factors may dictate individual action without regard to individual learning; organizational action without regard to individual action; environmental action without regard to organizational actions; or individual learning without regard to environmental action. At any point in the cycle, external factors may significantly influence and alter the assumptions of a complete cycle of organizational choice (March and Olsen).

What then are the perceived relative influences on the policy formation processes of institutions which use NCHEMS products? The responses to these questions are summarized in Table III-6, entitled Factors Which Influence Policy Formation at NCHEMS User Institutions. Influences on policy formation was used as a cross check on the impact of the use of NCHEMS products. Policy formation is an ambiguous process of formulation and implementation of institutional "choices" which have long-term influence on the institutions. Both strategic planning and management control are included (Bauer and Gergin).

Combining both to "great or some" extent, the two most important factors are the intuitive judgment of the chief executive officer and the interpretation of raw data. The next level of influence is internal staff analysis and recommendations of the faculty. The next level of influences include the political pressures of external constituents (i.e., governing boards, alumni, etc.) and the influence of funding agencies, including foundations and state and federal agencies. A lower level of internal influences is assigned to collective bargaining agents and information derived from quantitative tools, such as NCHEMS products. This relatively low influence on policy formation of the results of computer-based planning tools was confirmed by another study conducted for the Massachusetts Board of Regional Community Colleges (Arthur D. Little Systems and Opinion Research Corporation).

There are some important differences of these general influences. Perhaps the most important difference is the effect of an effective planning process upon the influences of policy formation. For those colleges which have high ratings with respect to effective planning, there is greater influence and participation by the internal staff, faculty recommendations, information derived from NCHEMS products, and interpretations of raw data. For the same institutions, there is less influence of the intuitive judgment of the chief executive officer and political pressures external to the institution. These institutions tend to be less unionized and subsequently less influenced by collective bargaining agents. The effect of effective planning processes is more important than the quality of data score. In those institutions which received a high score on the quality of data, information derived from quantitative tools was ranked to have more influence on policy formation than institutions with lower scores on the quality of data. This pattern suggests that, even if the quality of data of an institution is high, it is necessary to have an effective planning process to achieve a balanced and diverse set of influences with respect to policy formation. This trend further corroborates the concept that organizational validity is more important than technical validity in determining the usefulness of quantitative tools in decision-making.

TABLE III-6

FACTORS WHICH INFLUENCE THE SYNTHESIS PROCESS OF POLICY FORMATION

NCHEMS USER INSTITUTIONS

	Great Extent	Some Extent	Very Little	No Extent	No Opinion
Internal to Institution					
Intuitive judgment of chief executive officer	47%	44	6	2	1
Interpretation of raw data (such as enrollment figures, financial statements)	45%	48	6	1	*
Internal					3
Recommendations of faculty	26%	61	11	1	1
Collective bargaining agents	12%	20	16	43	
Information derived from quantitative tools (e.g., NCHEMS or other products)	7%	44	40	6	3
External to Institution					
Political pressures of external constituents (governing boards, alumni, etc.)	28%	46	22	3	1
Funding agencies (foundations, state and federal agencies)	38%	37	22	2	1

*Less than 1%.

The pattern of use of quantitative tools, both for all tools in general and NCHEMS tools in particular, demonstrates few differences as a function of the factors which affect policy formation. Those which are important include:

- The influence of the internal staff analysis was ranked to be higher at institutions which stop using NCHEMS tools than institutions which use NCHEMS tools, either alone or in combination with other tools;
- Funding agencies tend to have less influence on institutions which use NCHEMS products alone than on institutions that do not use NCHEMS tools singly or in combination with other tools; and
- There was no difference in influence with respect to the use of NCHEMS products, except a marked decrease in the influence of information derived from quantitative tools of those institutions which exclusively used AUPM.

This pattern in the lack of differences of the influence on policy formation as a function of the particular type of quantitative tools confirms the pattern identified by Schultz and Slevin; and Plourde.

The organizational context of the respondents influenced their assessment of the relative influences. Both institutional managers and academic unit managers believe that internal staff analysis has a higher influence on policy formation than do members of the analytic function. This difference is important in that many who have advocated the use of quantitative tools have been suspected because of their perceived bias in the usefulness of their own approaches, and have been thought to have overstated the potential usefulness of quantitative tools.

The institutional managers believe that their intuitive judgment has more influence than do academic unit managers. The institutional managers believe that the information derived from quantitative tools has more influence on policy formation than do members of the academic unit or the analytic function. Academic unit managers believe that funding agencies have a greater influence at their institutions than do the institutional managers or analytic function personnel. From the perspective of the size of the staff employed in the analytic function, the internal staff analysis showed that those institutions with analytic staffs of five or more professionals had more influence than institutions with smaller staffs. On the other hand, the influence of information derived from quantitative tools had more influence in those institutions which have staffs of less than five or more.

Governance patterns and organizational complexity affect the policy formation processes. Most notably, public sector institutions are more exposed to political pressures and influences from funding agencies than are private sector institutions. Collective bargaining agents have more influence in public four-year and two-year institutions, and have the most influence at public two year institutions. From the perspective of the governance pattern, internal staff analysis has more influence at systems offices than multi-campus institutions or individually governed institutions.

Political pressures of external constituents have more influence on institutions with enrollment patterns greater than 20,000 students than institutions with enrollments of less than 20,000 students. The influence of funding agencies is less at institutions with less than 2,000 students than for institutions with more than 2,000 students.

7. Factors Which Inhibit the Use of NCHEMS Products

Others who have investigated the use of quantitative tools in decision-making have found that communications between the person in charge of the analytic function and the decision-makers dictate how much influence the results of quantitative tools will have on decision-making (Schultz and Slevin; Hammond; Cox *et al.*). We asked the respondents who were familiar with the NCHEMS products their opinion of the factors which inhibit the use of NCHEMS products in their institution. In general, the need for decision-makers to receive training in the better use of the tools was ranked as the most influential inhibiting factor in the use of NCHEMS' products. The second and third most influential factors reported were:

- Decision-makers and analysts do not have compatible expectations about the purposes of NCHEMS' products; and
- There is a conflict between the decision-makers' needs to make more timely decisions and the analysts' needs to gather data and perform analyses;

The fourth most influential factor inhibiting the use of NCHEMS products is the fact that the roles of decision-makers and analysts are not clearly understood.

From these assessments, the lack of adequate training decision-makers is a very important inhibiting factor as perceived by administrators who are familiar with the NCHEMS products.

Now let us turn to differences within these general trends. First, the relative perceptions of the needs for better training of decision-makers in the use of the tools varies. Institutional managers are less likely to rank the importance of the need for training of decision-makers in the use of the tools than do academic managers or persons in charge of the analytic function. Administrators in public institutions believe that the lack of training is a less inhibiting factor than do administrators from private institutions. Institutions with enrollment patterns above 20,000 students believe that lack of training is less influential than do institutions with enrollment patterns below 20,000 students. Persons in charge of the analytic function who have other managerial responsibilities believe that the lack of training is more important than do full-time staff members in charge of the analytic function. For staff members in charge of the analytic function, those members who are a part of staffs of five or more professionals believe that the lack of training is more important than do staff members who are a part of an analytic staff that consists of one to four professionals.

The respondents in institutions with high scoring on the dimensions identified as effective planning believe the need for more training to be less important than do institutions who had medium to low scores on the effective planning. In terms of patterns of use of computer-based planning tools, institutions which exclusively use NCHEMS tools believe the lack of training to be more important than do institutions which are using NCHEMS tools in combination with other tools.

Recall that the second and third most influential factors inhibiting the use of NCHEMS products are: decision-makers and analysts who do not have compatible expectations about the purposes of NCHEMS products; and a conflict between decision-makers' needs to make timely decisions and analysts' needs to gather data and perform analyses.

Institutional management believes that the lack of compatible expectations about product purposes is less an inhibitor than do members of the academic management or analytic function. An analytic staff with from one to four professionals believes the lack of compatible expectations to be less important than do managers with other functions who perform the analytic function, or staff members who are a part of an analytic staff of five or more professionals. Administrators who believe that the application of quantitative tools requires an understanding of both the academic environment as well as the quantitative tools also believe the lack of compatible expectations to be less important than do those who believe that quantitative tools can be applied without concern for the academic environment. Institutions with high scores with respect to effective planning believe the lack of compatible expectations to be less important than do institutions with middle and low scores related to effective planning.

Institutions with low scores on the quality of data for decision-making believe the lack of compatible expectations to be more important than do institutions with middle or high scores with respect to the quality of data for decision-making. Institutions which use NCHEMS products exclusively believe that the lack of compatible expectations about the purposes of the products to be more important than do institutions which use NCHEMS products in combination with other products.

Now let us review the important differences in the findings regarding the conflict between the decision-makers' needs to make timely decisions and the analysts' needs to gather data and perform analyses. Members of the academic management believe this inhibiting factor to be more important than do members of the institutional management or analytic function. Public sector institutions believe this factor to be more important than do private sector institutions. Institutions which are individually governed or members of multi-campus systems believe this factor to be more important than do institutions which are part of a central office. Institutions with enrollments between 2,000 and 20,000 believe this factor to be more important than do institutions which have enrollment patterns either less than 2,000 students or greater than 20,000 students. Staff members who are part of an analytic staff of one to four professionals believe the conflict between decision-makers' needs and analysts' needs to be less important than do managers, analytic function personnel who are managers with other responsibilities, and analytic staff members who are a part of a staff of five or more professionals. Institutions with a high score related to effective planning believe that this conflict is less important than do institutions with middle or low scores with respect to substantive planning.

The importance of this factor tends to increase with a decrease in the score related to the quality of data available for decision-making. Institutions which use NCHEMS products exclusively believe this conflict between decision-makers' needs and analysts' requirements to be more important than do institutions which utilize NCHEMS products in combination with other tools.

The fourth most influential factor inhibiting the use of NCHEMS products is the lack of clarity in the role of decision-makers and analysts. Academic management believes this lack of clarity to be a more important inhibiting factor than do institutional managers or persons in charge of the analytic function. Respondents in public sector institutions believe this factor to be more important than do respondents in private sector institutions. Respondents in institutions which are part of a multi-campus system believe that this factor is less important than institutions which are individually governed or part of a central system. Institutions with enrollment patterns above 20,000 students believe the lack of clarity to be less important than do institutions with enrollment patterns under 20,000 students. Managers with other line responsibilities who are in charge of the analytic function believe that this lack of clarity is more important than do staff members in charge of the analytic function.

Administrators who believe that quantitative tools must be applied in a way that is sensitive to the educational environment believe the ambiguity of roles between decision-makers and analysts to be less important than do administrators who believe that quantitative tools can be applied without concern for the educational environment. Institutions with higher scores with respect to effective planning believe that the role in ambiguity is less important than do institutions with middle or low scores with respect to effective planning. Institutions with low scores with respect to the quality of data for decision-making believe that the lack of role definition is more important than do institutions with middle or high scores with respect to quality of data for decision-making. Institutions which utilize NCHEMS products exclusively believe that the lack of role definition is more important than do institutions which utilize NCHEMS products in combination with other tools.

8. Acceptance of the Role of Professional Management

The role of professional management in educational institutions has increased. Many have viewed this trend with alarm, while others have been most supportive (Brooke and Rourke;

Rourke; and Gross and Grambsch). The use of computer-based planning tools has been associated with the introduction of professional management in the educational institutions (Balderson). Respondents to the Phase II study were asked their views on the proper balance between understanding the educational environment and the application of management science and quantitative tools. The results of these questions are presented in Table III-7. There is strong agreement, 95%, that a personal understanding of the educational environment is essential for the successful application of management science and quantitative tools to postsecondary education problems. On the contrary, only 30% agree that management science and management science tools can be used successfully in postsecondary education without direct reference to the educational environment. Furthermore, 71% of the respondents believe that academic and institutional managers should have substantial academic careers before being appointed administrators. More academic unit managers believe that an academic career is important than do institutional management or analytic function personnel. These findings suggest that NCHEMS should emphasize that their staff should have a balance between understanding the educational environment and the application of management science and management science tools.

TABLE III-7

AGREEMENT TO THE ROLE OF PROFESSIONAL MANAGEMENT IN POSTSECONDARY EDUCATION

	Agree Strongly or Mildly	Disagree Strongly or Mildly	No Response
A personal understanding and experience in the education environment is essential for the successful application of management science and management tools in post-secondary education	95%	5%	0%
Management science and management tools can be used successfully in post-secondary education without direct reference to the educational environment	30%	70%	0%
Academic and institutional managers should have substantial academic careers before being appointed administrators	71%	28%	1%

9. Characteristics of Effective Planning

The characteristics of effective planning process are important with respect to the useful information in decision-making. The characteristics of effective planning are presented in Table III-8. A combined score divided into thirds was constructed by combining the responses to the questions. This combined score approximates "effective planning." A summary of the results is in Table III-8. The characteristics ranked highest are integration of academic, financial, and facilities planning and emphasis on interpersonal process, rather than just a document or a plan which is produced. Characteristics which also were ranked high include effective participation of relevant constituent groups, such as faculty, administration, students, and members of the governing board; institutional priorities and commitments defined; and breadth of scope, which include institution-wide issues. Characteristics ranked less highly include continuous rather than *ad hoc*, or sporadic, activities; and use of research based upon institutional data.

TABLE III-8

CHARACTERISTICS OF PLANNING PROCESSES OF INSTITUTIONS WHICH USE NCHEMS PRODUCTS

	Great or Some Extent	Very Little or No Extent	No Opinion
Emphasis on interpersonal *process* rather than just the document/plan which is produced	86%	10%	4%
Breadth of scope -- includes institution-wide issues	81	14	5
Integration of academic, financial, and facilities planning	89	19	2
Institutional priorities and commitments defined	81	17	2
Continuous, rather than *ad hoc* or sporadic activities	72	25	3
Uses research based on institutional data	70	27	3
Broad participation of relevant constituents such as faculty, administration, students, and members of the governing board	83	16	1

There are some important differences, however. Institutional and academic managers believe that the emphasis on process rather than upon the plan or document produced is higher than do members of the analytic function. The administrators in the private sector believe that emphasis on interpersonal process rather than upon the document of the plan is higher than do administrators in the public sector. Institutional managers believe that there is greater integration of academic, financial, and facilities planning than do members of the academic management or analytic functions. Institutions with low combined scores on the quality of data available for decision-making tend to achieve integration of academic financial and facilities planning less than do those with middle to high scores on the quality data available through decision-making.

Administrators in private institutions believe that institutional priorities and commitments are defined to a greater extent at their institutions than do administrators in public sector institutions. Administrators in institutions with enrollments greater than 20,000 students believe that institutional priorities are defined to a lesser extent than do administrators in institutions below 20,000 students. Institutions with a low score with respect to the quality of data available for decision-making believe that institutional priorities and commitments are defined to a lesser extent than do institutions which have middle to high scores with respect to the quality of data

available for decisionmaking. Private sector institutions have continuous, rather than ad hoc, or sporadic planning activities to a greater extent than do institutions in the public sector. The use of research based upon institutional data is achieved at a greater extent at institutions with high to middle scores with respect to the quality of data available for decision-making than do institutions with low scores on this dimension.

10. Characteristics of Budgeting Processes

In addition to the above general characteristics of planning, we asked Phase II respondents to characterize one of the major planning processes at their institution, viz., budgeting. The most frequently elected description was the line item nature of the budgeting process. The second most frequently selected description characteristic (56%) was planning, and the third most frequently selected description characteristic (36%) was performance and/or formula budgeting. The least frequently mentioned characteristic (only 15%) was zero-base budgeting.

The differences between these trends are as follows. Analytic function personnel believe that their budgeting process is less frequently characterized as planning than do the institutional management or the academic management. Respondents from institutions governed by multi-campus governing boards believe that their budgeting process to be more often characterized as planning than do respondents from individually governed institutions or institutions under a system office. Respondents from institutions with more than 20,000 students believe their budget process to be less frequently characterized as planning than do the respondents from institutions with less than 20,000 students. Institutions with a high score on the effective planning index believe their budget process to be more frequently characterized as planning than do institutions with middle or low scores. The use of line item budgeting is inversely related to increases in enrollment size, and the use of performance and/or formula budgeting is directly related to increases in enrollment size. Institutions in the public sector use performance and/or a formula of budgeting more than do institutions in the private sector. In the public sector, performance and/or formula budgeting are more often used by public universities and four-year institutions than by community colleges.

Seventy percent of those interviewed in Phase II believe that political negotiations influence budgeting in their institutions. Political negotiations have greater influences in public sector institutions than in private sector institutions; have greater influence in institutions under a multi-campus board or system than institutions which are individually governed; and have greater influence as a function of increasing enrollment size. Approximately one-half of the respondents believe that the budgets at their institutions are prepared under centralized decision-making assumptions, while approximately 40% of the respondents believed that the budgets in their institutions are prepared under decentralized decision-making assumptions.

Some 92% of the respondents believe that their institutions are successfully able to manage scarce resources. Institutions with low scores with respect to effective planning believe that they are less able to successfully manage scarce resources than do institutions with middle to high scores. Institutions with high scores with respect to the quality of data available for decision-making believe that they are better able to successfully manage scarce resources than do institutions with low scores.

CHAPTER IV

PATTERNS OF EVALUATION, TRIAL, AND ADOPTION OF NCHEMS PRODUCTS

During the Phase II study, we described in detail the three additional stages of the dissemination strategy:

1) patterns used by those institutions which utilized NCHEMS products to evaluate those products;
2) patterns used to conduct trial implementations; and
3) patterns used to adopt the products for specific institutional uses.

We investigated the specific forms in which the products were used by determining the degree to which NCHEMS products were tried as offered; tried with institutional modifications; adopted (either as offered or with modifications); or rejected.

We asked the representatives of the analytic function to suggest which of five product characteristics were most influential in their decisions with respect to evaluation, trial, and adoption of NCHEMS products. For those institutions which had discontinued the use of NCHEMS products, we asked for an explanation of the reasons why they had elected to discontinue using the products. In addition, we asked respondents to identify certain factors which they considered if they had decided to develop their own tools for meeting their objectives through their own internal institutional resources. Finally, we attempted to assess the pattern of product introduction, use, and discontinuance during the last decade.

In this section, we are concerned about patterns of evaluation, trial, adoption, and use related to the products themselves, and have not focussed upon the concepts imbedded in the products as discussed in Chapter III. The focus here is upon patterns of product use by institutions and the degree to which the characteristics of the products themselves contributed toward or inhibited the realization of NCHEMS' dissemination goals.

We divided the questions with respect to evaluation, trial, and adoption into two categories. Those institutions which had discontinued the use of NCHEMS products were asked a series of questions with respect to their patterns of evaluation, trial, and adoption and the reasons which led to their discontinuance of the products. Those institutions which currently use NCHEMS products were asked questions about the patterns of evaluation, trial, and adoption. Specific questions about product use, which will be discussed in Chapters V and VI.

A. PATTERNS OF INDIVIDUAL PRODUCT AWARENESS, EVALUATION, TRIAL, ADOPTION, AND CURRENT USE

In this section, we have reviewed, product by product, patterns of product awareness, evaluation, trial, adoption, and current use. We will focus upon both discontinued users, and current users, and those institutions which are aware of the products but have elected not to

evaluate them. Note that Plourde found that 58% of those who are currently using quantitative tools had not formerly evaluated their use at their institution. We found that only 1 to 3% (with differences by product) of the institutions utilizing NCHEMS products had not formerly evaluated these products as being appropriate for their particular uses. Therefore, our finding about product evaluation differs from those reached by the Plourde study. A summary of these patterns for each of the five products included in this study is presented in Figure IV-1.

1. Academic Unit Planning Model (AUPM)

As shown in Figure IV-1, 63% of the respondents of the Phase II study were aware of the Academic Unit Planning Model (AUPM), and 23% of the institutions included in the study had evaluated the AUPM with respect to its use at their institutions (40% of those who were aware of the product had not formally evaluated it). Based upon those who evaluated AUPM for use at their institution, about one out of four institutions elected to try the product. That means that 6% of the institutions in the study tried out AUPM for use at their institution. Of the the 6% of the total institutions who tried AUPM, 4% adopted it, and 3% were currently using the product as of Spring 1978.

2. Costing and Data Management System (CADMS)

Some 79% of the analytic function personnel were aware of CADMS, and 29% evaluated CADMS for a tryout at their institutions (50% of the analytic function personnel who were aware of CADMS had elected not to evaluate it). Based upon those who evaluated CADMS, nearly 2 out of 3 elected to try CADMS, which represents 20% of the institutions in this study. Some 18% of the total institutions elected to try to adopt the product, based upon their trial, but 2% rejected the product based upon the trial. Some 15% of the NCHEMS user population were currently using CADMS as of Spring 1978.

3. Information Exchange Procedures (IEP)

Some 88% of the analytic function personnel were aware of IEP, and 58% elected to evaluate it (30% who were aware of the product had elected not to evaluate it for their purposes). Some 42% elected to try the product based upon their evaluation and 16% rejected the product based upon their evaluation, which means that about 7 out of 10 tried the product following evaluation. After trying the product, 35% of the total institutions in the study adopted the product for their own use and 7% rejected the product. Some 29% of the NCHEMS user population are currently using IEP.

4. Program Classification Structure (PCS)

Some 89% of the analytic personnel were aware of PCS, and 61% elected to evaluate PCS as appropriate for their institution (28% of those aware of PCS had not evaluated it for use). Based upon those who evaluated PCS for use at their institutions, about 4 out of 5 elected to try the product. This means that 49% of the total institutions in the study tried PCS. Some 46% of the total institutions elected to adopt the product and 13% rejected the product. About 40% of the NCHEMS user population report they are currently using PCS.*

*Note that all postsecondary collegiate institutions are using PCS to some extent, minimally as respondents to HEGIS and other external reporting requirements.

Percentage Base: NCHEMS User Population (26% of Collegiate Sector)

FIGURE IV-1 PATTERNS OF PRODUCT USE NCHEMS USER POPULATION – COLLEGIATE SECTOR

5. Resource Requirements Prediction Model 1.6 (RRPM 1.6)

Some 87% of the analytic function personnel in the Phase II study were aware of RRPM, and 65% elected to evaluate the product (22% of the institutions had not evaluated the product for their purposes). Some 43% of NCHEMS users have tried the product and 22% have rejected the product based upon the evaluation, which means that about 2 out of 3 tried RRPM following evaluation. After trial, 22% adopted the product for their institutional uses, and 10% rejected the product based upon initial trial. However, 26% are currently using the product, although 7% have discontinued using it.

B. PATTERNS OF CURRENT AND DISCONTINUED USERS OF NCHEMS PRODUCTS

Above we reviewed the patterns of awareness, evaluation, trial, adoption, and current use of NCHEMS products on a product-by-product basis. In this section, we are reviewing trends across the five products. First, note in Figure IV-1 that there are significant differences between the stages of awareness, evaluation, and trial across all five products. The differences between these three stages are greater than the other stages. These differences suggest that NCHEMS' dissemination strategy should focus upon increasing the extent of evaluation and trial of their products with respect to use within a particular institution. It appears that institutions which formerly assessed the products proceed to adoption. Also, note in Figure IV-1 the small differences between trial, adoption, and current use patterns. It appears that once an institution has undertaken a trial of the product, the likelihood that the institution will continue to use the product is greater than the likelihood that the institution will reject the product. These patterns suggest that NCHEMS, through establishing more effective client/service linkages, can facilitate the degree to which NCHEMS products are utilized.

C. FORM OF PRODUCT USE

The products developed and disseminated by NCHEMS may be used by institutions either in the form offered by NCHEMS (with updates and modifications as released), or as offfered by NCHEMS with institutional modifications. The flexibility with which the products may be modified for specific institutional purposes enhances the possibility of products being adopted and utilized by institutions seeking to use the tools in a diverse set of institutional environments. We asked the analytic staffs to identify the forms of product use, after trial, adoption, and current use of the products utilized at their institutions. A summary of their responses is presented in the form of a bar chart in Figure IV-2 which presents the percentage of NCHEMS users and the product form in which they are using the products, arrayed by the five products in this study. Note that the percentage basis for this figure is the same as those presented in Figure IV-1 with respect to trial, adoption, and current use. The small number of cases covered in the study did not permit significant comparisons. However, note that there is a pattern in which approximately one-half of the participants used the products with institutional modification. While not conclusive in terms of statistical evidence, this pattern appears significant, however, with respect to NCHEMS' dissemination strategy.

This pattern further confirms the notion that NCHEMS products are tools to disseminate concepts. The greater the flexibility in adopting the products to a diverse set of environment, the greater it appears the possibility that the products will be utilized. One could extend this argument to suggest that greater attention should be paid to facilitating such adoption in the design of the technical tool which is developed to disseminate specific concepts. Note that,

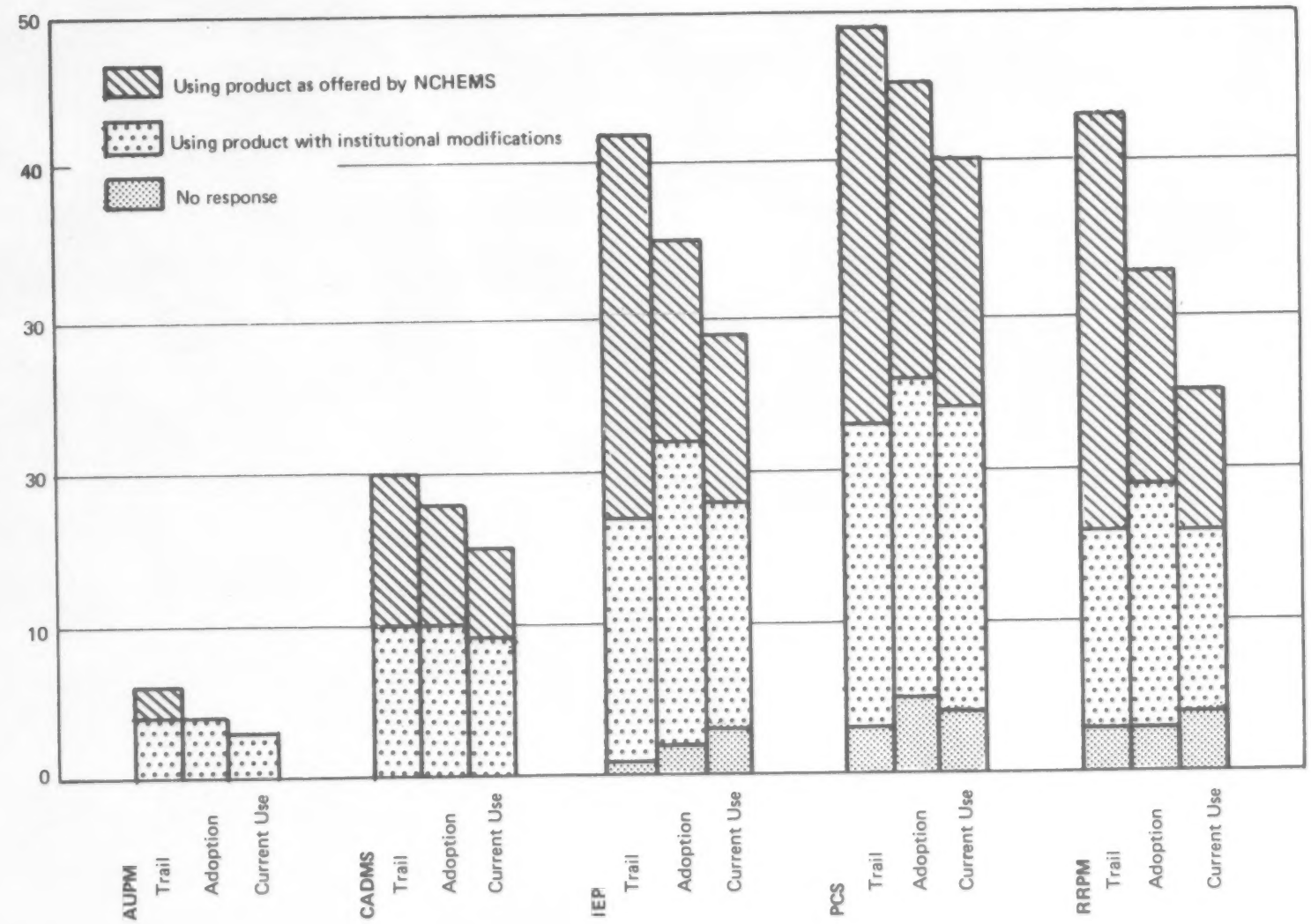


FIGURE IV–2 FORMS OF NCHEMS PRODUCT USE NATIONAL CENTER FOR HIGHER EDUCATION MANAGEMENT SYSTEMS

although the differences are not large enough to be significantly different from a statistical point of view, a pattern of current use suggests that current participants are using the products with institutional modifications more than in a form as offered by NCHEMS.*

D. INFLUENCE OF PRODUCT CHARACTERISTICS

We attempted to investigate the relative influence of five characteristics of the NCHEMS products included in this study. We were particularly interested in the degree to which these five characteristics affect evaluation, trial use, and adoption of the products. The characteristics were determined from review of previous studies — notably those of Plourde, Gonyea, and Cox — in which important characteristics of computer-based planning tools were identified. We summarized the various characteristics of products utilized in previous studies, combined with our own experience, to determine the following five:

- Initial cost;
- Maintenance cost;
- Flexibility;
- Availability of NCHEMS staff for technical assistance; and
- Sophistication of algorithms.

In addition, we included an "other" category to permit respondents to indicate other characteristics which they believe to be important. The analytic staff personnel were asked to indicate the degree to which the above product characteristics had affected their decisions to evaluate the product, undertake a trial implementation, and to adopt the product for their use. These questions were asked of both discontinued users and current users of NCHEMS products. Unfortunately, because of the limited number of cases, we were unable to determine statistically significant differences between and among the relative influences of these five characteristics. All five characteristics were indicated to have had some influence on the utilization of the products.

E. REASONS FOR DISCONTINUING PRODUCT USE

For those users who had adopted one or more of the products in this study but then discontinued their use, we asked the analytic staff personnel to indicate the reasons why they had discontinued use of the product. Again, because of the small number of cases in this category (from 1% to 7% as indicated in Table IV-1), we are unable to determine statistically significant differences among the alternatives presented to the respondents. However, note that 2% of the respondents who had utilized IEP, PCS, and RRPM indicated that product use was discontinued because the task for which the product was designed was completed. Note the importance assigned to lack of trained internal staff, that output took too much time, and that data were untimely with respect to IEP, PCS, and RRPM.

F. DECISIONS TO DEVELOP COMPUTER-BASED PRODUCTS USING INTERNAL STAFF

One of the questions of interest with respect to utilization of NCHEMS products revolved around those factors which users consider in their decision on whether to adopt an NCHEMS product, or to develop the product utilizing their own staff resources. We asked the analytic

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* For all AUPM, current users of institutions in this study made modifications to the product.

TABLE IV-1

REASONS WHY A PRODUCT'S USE WAS DISCONTINUED

	AUPM	CADMS	IEP	PCS	RRPM
Respondent Base (percentage of NCHEMS Users)	1%	3%	6%	6%	7%
Successful Implementation					
The task for which the product was designed was completed	0%	0%	2%	2%	2%
Unsuccessful Implementation					
Inadequate money budget to continue project	0%	0%	2%	0%	0%
Lack of trained internal staff	0	0	3	4	4
Insufficient commitment of institutional management time	0	0	3	2	2
Insufficient commitment of academic administrators	0	0	3	4	4
Difficulties in use of the product	0	0	1	0	*
Inadequate computer facilities	0	1	1	1	0
Decision-makers could not understand output	0	0	1	2	0
Product only told us what we already knew	0	0	0	0	2
Output took too much time; data untimely	0	0	3	1	1
Results too quantitative, ignore qualitative aspects	0	0	1	0	2
Provided more information than we needed	0	0	0	2	0
Incurred cost exceeded realized benefits	0	0	1	0	3
Person who advocated use of product left or was promoted	0	0	1	2	2
No response; don't know	1	2	2	*	2

function personnel to identify those factors which they considered in arriving at this decision. Because of the low number of cases of respondents, it is not possible to determine statistically significant differences.

The responses are presented in Table IV-2. Note the importance assigned to each product area with respect to staff qualifications; how long it would take to complete the project; and the cost.

TABLE IV-2

FACTORS AFFECTING DECISIONS TO DEVELOP COMPUTER-BASED PRODUCTS USING INTERNAL STAFF

	AUPM	CADMS	IEP	PCS	RRPM
Respondent Base	**3%**	**8%**	**9%**	**12%**	**8%**
Staff qualifications	2	5	9	11	5
What to do with staff when modeling is done	*	1	2	1	1
How long to complete	2	5	6	8	5
Cost	2	5	7	8	7
Other (Specify)	0	0	0	1	1

G. TIMING WITH RESPECT TO THE UTILIZATION OF NCHEMS PRODUCTS

We asked both discontinued users and current users to indicate when they had begun utilizing one or more of the products included in this study, and we then asked discontinued users when they had specifically stopped using the product. The results of these questions are summarized in Tables IV-3, IV-4, and IV-5.

Table IV-3 indicates when discontinued users first began utilizing an NCHEMS product. Again, the percentage based for this category is too small to determine statistically significant differences. However, note that the product's use began between 1972 and 1975. Also note in Table IV-4 that the institutions quit utilizing the products between 1975 and 1977. There appears to be an active period in which use of the product(s) began (1972 to 1975) and a period in which use of the product(s) was discontinued (between 1975 and 1976).

In Table IV-5 we have indicated the timing of the use of NCHEMS products for institutions which are currently utilizing the products. Note that the period in which they began using the products extended from 1970 through 1976. With the exception of RRPM (where 5% of the NCHEMS user population initiated use of the product in 1977) all the other products indicated a marked decrease in users who had initiated product use after 1976.

TABLE IV-3

YEARS IN WHICH DISCONTINUED NCHEMS USERS
INITIATED USE OF NCHEMS PRODUCTS
INCLUDED IN THIS STUDY

	AUPM	CADMS	IEP	PCS	RRPM
Respondent Base	1%	3%	6%	6%	7%
1970	0	0	0	0	0
1971	0	0	0	0	0
1972	0	1	2	1	1
1973	0	1	1	3	3
1974	0	0	1	0	2
1975	0	0	3	1	0
1976	0	0	0	0	0
1977	0	0	0	0	0
1978	0	*	0	0	0
Don't Know	1	1	0	0	1

TABLE IV-4

YEARS IN WHICH DISCONTINUED NCHEMS USERS
STOPPED USING THE PRODUCTS IN THIS STUDY

	AUPM	CADMS	IEP	PCS	RRPM
Respondent Base	1%	3%	6%	6%	7%
1970	0	0	0	0	0
1971	0	0	0	0	0
1972	0	0	0	0	0
1973	0	0	*	*	1
1974	0	0	0	0	0
1975	0	1	1	1	1
1976	0	1	3	5	3
1977	0	0	1	0	0
1978	0	0	0	0	1
Don't Know	1	2	1	0	1

TABLE IV-5

YEARS IN WHICH CURRENT USERS OF NCHEMS PRODUCTS INCLUDED IN THIS STUDY INITIATED PRODUCT USE

	AUPM	CADMS	IEP	PCS	RRPM
Respondent Base	3%	15%	27%	40%	26%
1970	0	0	0	1	2
1971	0	1	0	3	1
1972	0	1	2	0	1
1973	0	2	2	3	1
1974	0	2	4	7	7
1975	*	7	10	7	3
1976	2	1	9	6	1
1977	0	1	1	1	5
1978	0	0	0	1	1
Don't Know	1	1	2	6	4

CHAPTER V

WHO USES THE TOOLS, WHY, HOW, AND WITH WHAT BENEFITS?

It is important within the context of a product impact study to understand who uses NCHEMS tools; why they use them; how the tools are used; and what benefits are derived. Each of these questions was investigated, product by product, in this study.

A. WHO USES THE OUTPUTS OF NCHEMS PRODUCTS

The users of the outputs of the products are indicated in Table V-1, for each of the five products in the study by major administrative groups—institutional and academic unit management, and analytic personnel. Note that for Information Exchange Procedures and the Resource Requirements Prediction Model, analytic function personnel make greater use of the output of the models than do institutional or academic unit management. For Program Classification Structure, institutional management ano analytic function personnel make greater use of the products than do the academic unit management. There is no difference in the use of the Costing and Data Management System among the three administrative groups. The responses to the Academic Unit Planning Model are so small that these responses do not permit comparisons across the three administrative groups. Also note, in Table V-1 however, that each of the administrative groups makes use of the tools. While there are differences between and among the administrative groups, institutional and academic unit management appear active in their use of the results of the models.

TABLE V-1

WHO USES THE RESULTS OF THE NCHEMS PRODUCTS IN THIS STUDY

	AUPM	CADMS	IEP	PCS	RRPM
RESPONDENT BASE (CURRENT USERS OF NCHEMS PRODUCTS)	**3%**	**15%**	**29%**	**41%**	**26%**
ADMINISTRATIVE GROUPS					
Institutional Management	69%	69%	51%	60%	48%
Academic Unit Management	69	69	44	29	44
Analytic Function Personnel	100	79	74	73	86

B. REASONS INSTITUTIONS USE NCHEMS PRODUCTS

Institutions use NCHEMS products for a variety of reasons, as summarized in Table V-2. All of the findings on product use in this section are based upon respondents selected options from a pre-coded list. The reasons institutions use the NCHEMS products will be reviewed on a product-by-product basis.

TABLE V-2

REASONS INSTITUTIONS USE NCHEMS PRODUCTS

	AUPM	CADMS	IEP	PCS	RRPM
RESPONDENT BASE (CURRENT USERS OF NCHEMS PRODUCTS)	**3%**	**15%**	**29%**	**41%**	**26%**
REASONS INSTITUTIONS USE NCHEMS PRODUCTS					
Requirement for more useful day-to-day institutional management	22%	36%	25%	19%	25%
Internal requirement	0	19	13	3	12
External funding/governance requirement (consider central or system office to be external)	0	51	74	64	24
Need for forecasting ability (consideration of alternatives)	57	41	22	17	49
Need for analysis of historical trends	79	57	58	38	53
Need for integration of institutional data	69	63	52	44	50
Better data required to react to external queries	0	74	35	34	20
Better data required to allocate increasingly scarce resources	69	70	33	32	61
Pilot project experiment (not intended for use in costing or planning activities)	9	9	12	5	17
Improve design of information system to meet needs of decision-makers	22	52	45	40	57
Facilitate adoption of program budgeting (rational budgeting)	57	38	21	26	20
No stated or intended objectives	9	0	0	0	6
Other	2	2	1	8	4

1. Academic Unit Planning Model

Because of the small respondent base for AUPM (only 4 cases), it is difficult to interpret these findings. Note in Table V-2 that frequently mentioned reasons for using AUPM include:

- The need for analysis of historical trends;
- The need for integration of institutional data;
- Better data required to allocate increasingly scarce resources;
- The need for forecasting ability; and
- Facilitate adoption of the program budgeting.

Other than AUPM, to facilitate the adoption of program budgeting is not a frequently-mentioned reason for use of the NCHEMS products included in the study.

2. Costing and Data Management Systems

Frequently mentioned reasons for using CADMS include:

- Better data required to react to external queries;
- Better data required to allocate increasingly scarce resources;
- Need for analysis of historical trends;
- Improved design of the information systems;
- External funding/governance requirement.

3. Information Exchange Procedures

Frequently cited reasons for utilizing IEP include:

- External funding/governance requirement;
- Need for analysis of historical trends;
- Need for integration of institutional data; and
- Improved design of information system to meet needs of decision-makers.

Note in Table V-2 the high importance assigned to external funding/governance requirement for the use of the Information Exchange Procedures.

4. Program Classification Structure

Frequently cited reasons for utilizing the PCS include:

- External funding/governance requirement;
- Need for integration of institutional data; and
- Improved design of information systems to meet the needs of decision-makers.

5. Resource Requirements Prediction Model 1.6

Frequently cited reasons for utilizing the RRPM include:

- Better data required to allocate increasingly scarce resources;
- Improved design of information system to meet the needs of decision makers;
- Need for analysis of historical trends;
- Need for integration of institutional data; and
- Need for forecasting ability

For those institutions which utilized one or more of the products in this study because of external funding/governance requirements, we asked the respondent to indicate which external funding/governance agencies were requiring the use of NCHEMS products. These results are presented in Table V-3. Note in that table that state-wide coordinating/governing boards and legislature branches of state government are the two most frequently-mentioned agencies requiring the use of NCHEMS products. Note that central and systems offices are not frequently mentioned. All of the products in this study were elected because their primary focus is on institutional level decision-making. However, external agencies requiring the use of such products appear to have a significant impact on reasons why institutions are using the products.

TABLE V-3

EXTERNAL FUNDING/GOVERNANCE AGENCIES REQUIRING INSTITUTIONS TO USE NCHEMS PRODUCTS

	AUPM	CADMS	IEP	PCS	RRPM
RESPONDENT BASE (% OF CURRENT NCHEMS USERS INDICATING THAT EXTERNAL FUNDING/ GOVERNANCE REQUIREMENT AS A REASON FOR USING NCHEMS PRODUCTS)	0	51%	41%	64%	24%
EXTERNAL FUNDING/GOVERNANCE AGENCIES REQUIRING THE USE OF NCHEMS PRODUCTS					
Central office of multi-branch institution	0%	0%	7%	9%	0%
Systems office of multi-campus system	0	7	8	4	1
Statewide coordinating governing board	0	31	54	54	7
Other executive office of state government	0	6	7	15	14
Legislative branch of state government	0	25	19	24	15
Requirement/part of a grant or contract from a federal agency	0	2	1	9	11
Requirement/part of a grant or contract from a private source or sources (foundation, corporation, etc.)	0	0	5	0	0
Other	0	9	5	3	3

C. HOW NCHEMS TOOLS ARE GENERALLY USED IN DECISION-MAKING

The results of how NCHEMS tools are used in decision-making are presented in Table V-4, and are reviewed below.

TABLE V-4

HOW NCHEMS TOOLS ARE USED IN DECISION-MAKING

	AUPM	CADMS	IEP	PCS	RRPM
RESPONDENT BASE (CURRENT USERS OF NCHEMS TOOLS)	3%	15%	29%	41%	26%
HOW NCHEMS TOOLS ARE USED					
To make decisions	57%	45%	20%	13%	25%
To prepare internal reports	22	60	51	43	55
To prepare reports for external agencies	22	69	62	69	27
For staff analysis	0	74	54	41	64
To define problems and generate alternatives	9	35	12	11	30
To analyze alternatives and test assumptions	0	18	13	9	38
To validate own thoughts, intuition, and wisdom	0	36	27	15	39
To perform analysis required of your job responsibilities	19	46	34	30	33
To help internal communications	41	15	23	20	16
To help inter-institutional communications	0	24	29	22	10
To ease accountability pressures	0	29	30	22	9
As a transition from qualitative-based to quantitative-based management	9	35	31	16	31
To develop data bases of the institution	69	64	38	57	34
To develop questions about institutional operations	0	17	17	18	48
Other	2	2	4	6	1

1. Academic Unit Planning Model

As mentioned above, the low response rates for AUPM inhibits the reliability of these responses. Frequently mentioned uses for AUPM include:

- To develop data bases of the institution;
- To make decisions; and
- To help internal communications.

2. Costing and Data Management System

Frequently mentioned reasons for using CADMS include:

- To prepare reports for external agencies;
- To prepare internal reports;
- For staff analysis;
- To develop data bases of the institution; and
- To make decisions.

3. Information Exchange Procedures

Frequently mentioned reasons for using IEP include:

- To prepare reports for external agencies;
- For staff analysis; and
- To prepare internal reports.

4. Program Classification Structure

Frequently mentioned reasons for using PCS include:

- To prepare reports for external agencies;
- To develop data bases of the institutions;
- To prepare internal reports; and
- For staff analysis.

5. RRPM

Frequently mentioned uses of RRPM include:

- For staff analysis;
- To prepare internal reports; and
- To develop questions about institutional operations.

D. RELEVANCE OF NCHEMS TOOLS TO THE PLANNING AND MANAGEMENT FUNCTIONS OF USER INSTITUTIONS

We investigated the degree to which the NCHEMS products were utilized in discharging the planning and management functions of NCHEMS-user institutions. The results of these investigations, presented in Table V-5, first identify the planning and management functions (including strategic planning processes and management control processes); next the task for which no products were used; the products which were used for planning and management tasks; and finally an assessment of the relevance of the products used to each task. These questions were asked of decision-makers who were either very or fairly aware of one or more of the products. The assessment of product relevance was only asked of those who had used one or more of the products for a particular planning and management task. As noted in Table V-5, resource allocation and evaluation/reporting/analysis were the most frequently mentioned planning and management task for which the NCHEMS products were used, followed in decreasing order of use by institutional management and control, strategic planning, resource acquisition, and constitutional/statutory decisions.*

* See Chapter II for a definition of these planning and management tasks.

TABLE V-5

USE AND RELEVANCE OF NCHEMS TOOLS IN THE PLANNING AND MANAGEMENT TASKS OF NCHEMS-USER INSTITUTIONS

Planning and Management Tasks	No Product Used*			Products Used*						Relevance to Planning and Management Tasks†			
	Task Not Applicable to Respondent's Responsibilities	Product Not Used	Sub-Total	% of Products Used (Multiple Responses)						Great and Some Extent	Little and No Extent	No Opinion	Unweighted† Respondent Base (Actual Number)
				AUPM	CADMS	IEP	PCS	RRPM	Not Known Which				
Strategic Planning Constitutional/Statutory Authority Decisions	14%	63%	77%	3%	4%	6%	10%	3%	5%	49%	30%	21%	63
Strategic Planning Decisions	11	37	48	6	17	14	20	18	5	66	24	10	144
Management Control													
Resource Acquisition	10%	48%	58%	2%	12%	14%	15%	13%	4	58	29	13	114
Resource Allocation	10	33	43	4	17	16	21	23	2	70	26	4	160
Institutional Management and Control	11	37	47	5	15	16	23	16	3	66	29	5	150
Evaluation/Reporting/Analysis	11	28	38	4	16	24	26	17	5	70	23	7	182

*Respondent base for this set of questions was those respondents who know one or more of the five products very or fairly well.

†Respondent base are those individuals who have actually used one or more of the five products included in this study.

The next section of Table V-5 indicates the NCHEMS products which were utilized in discharging the planning and management functions of their institutions. Multiple responses were allowed. In this table, note the low use of AUPM in all of the six planning and management functions. Also note the degree to which the other four products (CADMS, IEP, PCS, and RRPM) were utilized in combination for planning and management tasks other than constitutional/statutory authority decisions.

Those decision-makers who had ever used one or more of the products in the study in discharging a planning and management task were asked to assess the relevance of those products with respect to planning and management tasks at their institution. This assessment is made based upon the combination of products utilized as suggested in the previous column of Table V-5. The combination of tools were assessed to be relevant either to "great" or "some extent" by 70% of the respondents for each resource allocation and evaluation/reporting/analysis tasks; 66% for each strategic planning and institutional management and control; 58% for resource acquisition; and 49% for constitutional/statutory authority decisions. The number of decision-makers making these assessments is also presented in the last column of Table V-5.

What benefits are realized from the utilization of NCHEMS products? The summaries to the responses to this question are presented in Table V-6 and will be reviewed on a product-by-product basis.

1. Academic Unit Planning Model

Note the low response base for AUPM. Frequently mentioned benefits include:

- Improved design of information system;
- Increased acceptance, within the institution, of results of decision-making;
- Demonstrates good management practice;
- More confident decision-making;
- Increased acceptance by people outside the institution;
- Demonstrate good management practice; and
- Facilitate reporting to external agencies.

2. Costing and Data Management Systems

Frequently mentioned reasons for utilizing CADMS include:

- Better understanding of the institution's activities;
- Improved design of information system(data base);
- Facilitate reporting to external agencies;
- Increase acceptance, within the institution, of results of decision-making;
- Increase acceptance by people outside of the institution of the results; and
- Better quality decision-making.

3. Information Exchange Procedures

As presented in Table V-6, benefits realized from the use of IEP which were frequently mentioned include:

- Facilitate reporting to external agencies;
- Improved design of the information system;
- Better understanding of our institution's activities.

TABLE V-6

BENEFITS REALIZED FROM THE USE OF NCHEMS PRODUCTS

	AUPM	CADMS	IEP	PCS	RRPM
RESPONDENT BASE (CURRENT USERS OF NCHEMS PRODUCTS)	**3%**	**15%**	**29%**	**41%**	**26%**
BENEFITS REALIZED FROM THE USE OF NCHEMS PRODUCTS					
Costing savings	0%	20%	12%	12%	12%
More timely decision-making	0	27	12	19	23
Better quality decision-making	47	43	30	26	38
More confident decision-making	47	65	32	23	34
Increase acceptance, within the institution, of the results of decision-making	69	46	27	23	27
Increase acceptance by people outside the institution of the results	0	44	31	36	12
Better understanding of our institution's activities	41	71	51	43	63
Permits sensitivity analysis	47	26	9	6	17
Permits exploration of more alternatives than previously	22	26	19	15	25
Improve design of information system (data base)	79	59	60	47	45
Facilitate adoption of program budgeting	9	40	18	30	21
Understand concepts represented by products, not just the products themselves	0	43	18	9	8
Serves as an avenue for the development and implementation of more appropriate models/tools	32	27	29	28	33
Satisfy curiosity about the use of planning and management tools	9	10	11	4	14
Demonstrate good management practice	57	41	33	24	18
Facilitate reporting to external agencies (including your central or system office)	47	55	66	70	20
Other	2	0	7	4	7

4. Program Classification Structure

In frequently mentioned reasons for utilizing PCS, the following were included:

- Facilitate reporting to external agencies;
- Improve design of information system; and
- Better understanding of our institution's activities.

5. Resource Requirements Prediction Model 1.6

Frequently mentioned reasons for using RRPM include:

- Better understanding of the institution's activities;
- Improve design of information system (data base); and
- Better quality decision-making.

Other less frequently mentioned benefits are presented in Table V-6.

E. BENEFITS DERIVED FROM THE USE OF NCHEMS PRODUCTS

Others who have investigated the use of quantitative tools have found that, even if the use of the quantitative tool itself was unsuccessful, that the experience of decision-makers in utilizing the tools has produced a change in attitudes, understanding, and emphasis on the part of the decision-makers (Cox). We asked the respondents, both during Phase I and Phase II, to indicate whether they believe that decision-makers at their institution have experienced a change in attitudes, understanding, and emphasis resulting from the use of computer-based tools. The results of the Phase I study are presented in Figure V-1. Note in this figure that 40% of the institutions which have not used NCHEMS or other computer-based tools believe that such changes have occurred. For institutions that utilize NCHEMS tools exclusively, the changes in attitudes, understanding and emphasis increases to 60%, which is a significant difference. If institutions use tools other than NCHEMS, 71% of the respondents believe that the decision-makers in their institution had experienced a change in attitudes, understanding, and emphasis. However, if NCHEMS tools are utilized in combination with other tools, 76% of the respondents believe that the decision-makers in their institutions had realized a change in attitudes, understanding, and emphasis. This difference is significant when compared to the benefits derived from institutions using NCHEMS tools.

The above patterns of product use suggests that institutions which make more extensive utilization of the analytic process by utilizing a variety of computer-based planning tools realize greater benefits than those institutions which singly utilize NCHEMS tools. This pattern suggests that the dissemination strategy of NCHEMS should encourage users to utilize other tools, including tools developed by the institution and those acquired from external sources other than NCHEMS.

The same question was asked of our Phase II respondents. There were no significant differences with respect to the following independent variables: type of respondent; pattern of use of NCHEMS tools, either NCHEMS tools exclusively or NCHEMS tools in combination with other tools, or institutions which had discontinued the use of NCHEMS tools; or combinations of the use of NCHEMS tools. There were no differences in changes in attitudes, understanding, and emphasis with respect to the beliefs in the role of professional management and the quality of data available for decision-making.

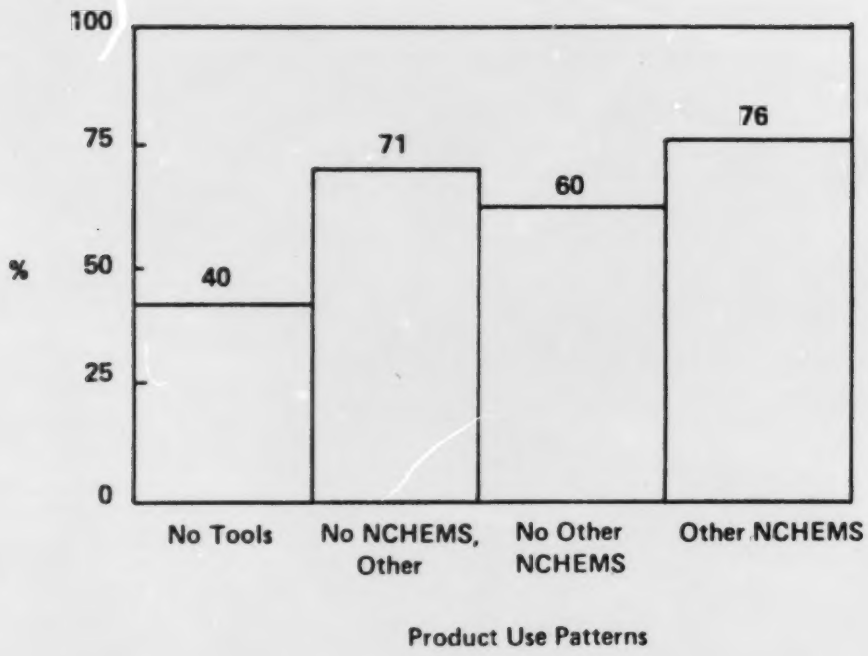

FIGURE V-1 CHANGES IN ATTITUDES, UNDERSTANDING, AND EMPHASIS – COLLEGIATE SECTOR

Significant differences were determined with respect to governance structure, in that institutions under system offices realized changes in attitudes, understanding, and emphasis less than institutions which are individually governed or under multi-campus systems. Institutions with enrollments over 20,000 experienced this change in attitudes, understanding, and emphasis more than did institutions with enrollment patterns under 2,000. Institutions with a low score with respect to effective planning realize these benefits of changes in attitudes, understanding, and emphasis less than institutions with middle or high scores.

CHAPTER VI

ORGANIZATIONAL VALIDITY

The term *(Organizational validity)* in context describes the degree to which the assumptions incorporated in the design and development of a computer-based planning and management tool are consistent with the actual behavior of the decision-makers intended to use the tool. Organizational validity is more influential with respect to the planning tools that are used in decision-making than *(technical validity)* of the tools — defined as the degree to which the model accomplishes its technical objectives. (Schultz and Slevin). In this study, we have not investigated the technical validity of the five NCHEMS products. However, we have investigated organizational validity from two perspectives:

- Trends which are inherent in all five of the NCHEMS products included in this study; and
- Assumptions which are made specific to an individual product.

Each of these investigations is summarized below.

A. TRENDS INHERENT IN PRODUCTS INCLUDED IN THIS STUDY

From our characterization of the five products selected for this study, we identified several trends which appeared to be inherent in all of them. This characterization process was reviewed by the NCHEMS staff and is presented in Appendix A. We asked each of the Phase II study respondents who were either very or fairly familiar with the products to indicate the degree to which they agreed with these assumptions. The results of the questions we posed are summarized in Table VI-1.

Some 98% of the respondents of this study agreed that postsecondary education institutions' planning and management were generally in need of improvement. Some 96% agreed, either strongly or mildly, that improvement could be gained through the use of structured frameworks for information-gathering and analysis. Furthermore, 98% agreed, either strongly or mildly, that improvement could be gained through better and more consistent information and analysis, and 90% agreed, either strongly or mildly, that such improvement could be gained if consistent information were shared through a structural mechanism such as NCHEMS.

Another 84% agreed, either strongly or mildly, that more quantitative information might lead to better decision-making. Based on these responses, it appears that those who have utilized NCHEMS tools believe — from the perspective of their respective institutions — that there is a need to improve the management of educational institutions through structured frameworks, better and more consistent information and analysis, and sharing of consistent information.

The remaining questions related to the method by which such improvements could be achieved. Some 84% of those interviewed agreed, either strongly or mildly, that normative models could be developed deductively and could help institutions in their management activities.

TABLE VI-1

ORGANIZATIONAL VALIDITY –
ASSUMPTIONS WHICH ARE INHERENT ACROSS ALL FIVE OF THE
NCHEMS PRODUCTS INCLUDED IN THIS STUDY

	Agree Strongly	Agree Mildly	Disagree Mildly	Disagree Strongly	No Response
Post-secondary institution decision-making, management, and planning are generally in need of improvement	80%	18	1	0	1
Improvement may be gained through the use of *structural frameworks* for information gathering and analysis	58%	38	2	*	2
Improvement may be gained through better and more *consistent* information and analysis	78%	20	1	*	1
Improvement may be gained by the *sharing of consistent information* brought about by structural mechanisms such as the NCHEMS products	46%	44	8	1	1
More *quantitative information* leads to better decision-making	33%	51	12	2	2
Normative models (i.e., how decision-making, management, and planning ought to be) can be *deductively* developed and can help institutions in their management activities	23%	61	14	*	2
Inductive processes (i.e., empirical data gathering, analysis, and synthesis) can be delayed until a product is field tested	7%	36	41	11	5
The emphasis should be on a *macro-analytic or central administrative view* with regard to the gathering and analyzing of quantitative information	14%	52	26	6	2
The focus is on institutional *internal information of the present to the exclusion of external effects and uncertainties of the future* (e.g., economic, demographic, or student choice shifts)	9%	35	34	20	2
Productivity is the central evaluation measure with respect to institutional performance	11%	49	24	14	2

Respondent Base: Those who know one or more of the five products very or fairly well.
(302 of the 440 respondents)

However, 51% disagreed, either mildly or strongly, that inductive processes could be delayed until a product was field-tested. Another 66% agreed, either mildly or strongly, that a macro-analytic or central administrative view with regard to gathering information and gathering and analyzing quantitative information was appropriate. Some 54% of those interviewed believed that the present focus on internal information, with the exclusion of external directions and uncertainties for the future was inappropriate. Finally, only 60% agreed, either strongly or mildly, that productivity was a central evaluation measure with respect to institutional performance. Therefore, disagreement tended to be cited more often for those assumptions which related to the approach NCHEMS takes in developing its products.

B. SPECIFIC ORGANIZATIONAL VALIDITY OF NCHEMS PRODUCTS

In this section, we review the perceptions of organizational validity with respect to each of the products.

1. Academic Unit Planning Model (AUPM)

Only 3% of the institutions interviewed are currently using AUPM. Therefore, the responses presented in Table VI-2 are quite limited from a statistical point of view. However, notice that there was little agreement with respect to the assumptions of AUPM. The only agreement related to the extent that there are systematic institutional planning processes to support an institution's use of AUPM. This lack of agreement with respect to the assumptions of AUPM, in terms of its intent to assist institutions in discharging their planning and management functions, has perhaps contributed to its low use.

2. Costing and Data Management Systems (CADMS)

The organizational validity assessments of CADMS are presented in Table VI-3. Institutions which have used CADMS agree either greatly or to some extent with the assumptions of the model. There is very little disagreement with the assumptions of CADMS.

3. Program Classification Structure (PCS)

As presented in Table VI-4, one-half or more of the users of PCS either agreed to "great" or "some extent" with the assumptions of the model:

- PCS categories describe their organizational functions and activities;
- PCS is used in external reporting requirements to federal- and state-level agencies;
- PCS facilitates the integration of institutional data into program formats;
- PCS relates to the organizational units as well;
- PCS is used as a communication tool format in its institution; and
- PCS focusses on institutional factions and objectives rather than administrative units.

Less than 50% of the users of PCS agreed that PCS is used internally to relate programs and activities to the objectives of the institution.

TABLE VI-2

ORGANIZATIONAL VALIDITY
ACADEMIC UNIT PLANNING MODEL

	To A Great Extent	Some Extent	Very Little	No Extent	No Opinion
In your opinion, to what extent is AUPM being used in the identification and organization of data about academic unit functions within the context of your institution?	0%	41%	59%	0%	0%
To what extent does it help in the allocation of physical resources?	0	0	78	0	22
To what extent does it help in the allocation of physical resources?	0	31	69	0	0
To what extent is AUPM being used to identify the sources and uses of funds?	0	22	78	0	0
To what extent does it help in the planning and assessment of academic unit outcomes?	22	19	59	0	0
To what extent does AUPM provide assessment for qualitative as well as quantitative information?	0	0	31	47	22
To what extent has AUPM assisted in including faculty in academic planning?	0	41	12	47	0
To what extent are there systematic institutional planning processes to support your use of AUPM?	57	22	9	12	0

RESPONDENT BASE: CURRENT USERS OF AUPM – 3% OF NCHEMS USER POPULATION

TABLE VI-3

ORGANIZATIONAL VALIDITY
COSTING AND DATA MANAGEMENT SYSTEM

	To A Great Extent	Some Extent	Very Little	No Extent	No Opinion
To what extent does CADMS assist your institution in the implementation of cost studies?	63%	28%	5%	4%	0%
To what extent is it used for studies of current cost?	43	36	7	9	5
To what extent is it used for historical cost studies?	30	46	14	10	0
To what extent do you consider CADMS output to be a reliable simulator of student course selection behavior?	43	37	8	6	6
To what extent does CADMS support, or is it consistent with, your use of other NCHEMS products?	46	40	2	10	2
To what extent is the assumption that faculty activities can be analyzed or distributed consistent with contractual teaching and release-time obligations?	52	30	8	6	4

RESPONDENT BASE: CURRENT USERS OF CADMS – 15% OF NCHEMS USER POPULATION

TABLE VI-4

ORGANIZATIONAL VALIDITY
PROGRAM CLASSIFICATION STRUCTURE

	To A Great Extent	Some Extent	Very Little	No Extent	No Opinion
To what extent do the PCS categories describe your organizational functions and activities?	37%	38%	7%	1%	17%
To what extent is PCS used in external reporting requirements . . .					
HEGIS?	70	8	11	5	6
Financial audit reports?	32	18	8	21	21
State-level reporting?	47	29	4	12	8
Other external reporting?	23	26	17	11	23
To what extent is PCS used internally to relate programs and activities to the objectives of the institution?	15	21	29	21	4
To what extent are the functions described by PCS comparable to the functions of your institution?	37	51	4	3	5
To what extent does PCS facilitate the integration of institutional data into program (as opposed to organizational) formats?	29	42	6	12	11
To what extent does PCS relate to your organizational units?	25	60	3	5	7
To what extent does your institution use PCS as a communication tool or format (for example, in discussions of resource allocations, for comparative analysis of institutional programs, or comparative analysis with similar programs in other institutions)?	28	26	21	20	5
To what extent does PCS focus on institutional functions and objectives rather than on administrative units?	20	52	14	5	9

RESPONDENT BASE: CURRENT USERS OF PCS – 41% OF NCHEMS USER POPULATION

4. Information Exchange Procedures (IEP)

The assumptions of information exchange procedures are presented in Table VI-5. Note that one-half or more of the respondents agreed either to "great" or "some extent" that IEP was being used for collecting, organizing, and displaying information as the product was intended. There was one exception: the outcomes of student programs, in which only 26% indicated that IEP was being used to either "great" or "some extent" for that function.

The next set of assumptions explored the issue of the value to the institution of certain IEP outputs. Note that, for all of the outputs indicated, to "great extent" was indicated less frequently than to "some extent" with respect to the value of the output to the institution. Note also that no respondents indicated, to a "great extent," that cross-sectional data were considered valuable to their institution. Some 45% of the respondents indicated that, to "some extent," cross-sectional data were of value to their institution. The two outputs cited most frequently as being valuable to the institution, either to "great" or "some extent," were longitudinal institutional data and direct cost by unit of instruction. It appears that the value of IEP outputs to institutions was more in terms of intra-institutional comparisons than to inter-institutional comparisons.

Some 38% of the respondents indicated, to "great" and "some extent," that IEP was being used for institutional comparative analysis, particularly in the resource allocation context. However, 51% indicated, to "great" or "some extent," that IEP was being used to improve the quantity and quality of data the institution brings to bear on its internal planning and management processes. Another 54% indicated, to "great" or "some extent," that IEP assisted the institution in discharging its various reporting responsibilities.

5. Resource Requirements Prediction Model 1.6 (RRPM 1.6)

The assessment of organizational validity for RRPM 1.6 is presented in Table VI-6. These items will be reviewed with respect to the assumptions of the model, the uses for which the model was intended, and certain enhancements which have been suggested by those who have criticized the conceptual design of RRPM.

First, with regard to the assumptions incorporated in the conceptual design of the model, some 33% of the users of RRPM believed that, to either "great" or "some extent," the accumulation of academic credit units permitted simulation of the educational process or philosophy of their institutions. Note that 31% had no opinion on this issue. The average cost was determined to be appropriate for their purposes for 62% (either "great" or "some extent"), and 71% of those responding believed, to "great" or "some extent," that it was appropriate to simulate their institutions with respect to the instruction function as opposed to the research or public service function. Another 58% agreed, to "great" or "some extent," that actual faculty commitments at their institutions could be based upon contractual time commitments, while 41% of the respondents believed that deterministic projections (single value) were appropriate for their purposes. Finally, 70% agreed, to "great" or "some extent," that student demand for instruction could be approximated, utilizing the *induced course load matrix concept*, and 60% of the respondents agreed, to "great" or "some extent," that the factors represented by the key variables of RRPM could be affected by the management of their institutions.

TABLE VI-5

ORGANIZATIONAL VALIDITY
INFORMATION EXCHANGE PROCEDURES

	To A Great Extent	Some Extent	Very Little	No Extent	No Opinion
To what extent is IEP being used for collecting reorganizing, and displaying . . .					
General descriptive and supporting longitudinal institutional data (across time)?	23%	29%	23%	20%	5%
General descriptive and supporting data of a cross-sectional nature (for a group of institutions)?	16	34	21	17	12
Direct costs for all IEP Activity Centers?	34	39	11	3	13
Direct costs by unit of instruction?	42	30	15	5	8
Full costs for IEP-defined "final cost objectives"?	31	20	16	21	12
Full costs by unit of instruction%	29	30	13	20	8
Outcomes of student programs?	4	22	21	45	8
To what extent is IEP data from your institution being used by funding agencies?	16	36	3	32	13
To what extent do you find the following IEP outputs *valuable* in your institution . . .					
Longitudinal institutional data (across time)?	10	54	15	13	8
Cross-sectional data (for a group of institutions)?	0	45	20	24	11
Direct costs for all IEP Activity Centers?	16	29	17	23	15
Direct costs by unit of instruction?	21	33	18	17	11
Full costs for IEP-defined "final cost objectives"?	10	17	28	29	16
Full costs by unit of instruction?	12	23	23	30	12
Outcomes of student programs?	5	23	6	34	12
To what extent is IEP being used in your institution . . .					
For institutional comparative analysis, particularly in the resource allocation context?	11	27	17	32	13
To improve the quantity and quality of data that the institution brings to bear on their internal planning and management?	18	33	25	12	12
To assist the institution in discharging their various reporting responsibilities?	29	25	19	20	7

RESPONDENT BASE:

TABLE VI-6

ORGANIZATIONAL VALIDITY
RESOURCE REQUIREMENTS PREDICTION MODEL 1.6

	To A Great Extent	Some Extent	Very Little	No Extent	No Opinion
To what extent is RRPM used to test alternative strategies in your institution for making future cost projections?	6%	23%	33%	21%	17%
For historical cost analysis?	11	31	29	23	6
For current cost analysis?	12	26	32	19	11
To what extent is it used by organizational units for line-item budget data?	3	2	36	54	5
To what extent is it used for program budget reports indicating discipline or department contributions to instructional programs?	3	39	18	32	8
To what extent is RRPM used for current cost analysis?	9	23	45	18	5
To what extent does the assumption of accumulated academic credit units permit you to simulate your educational process or philosophy?	4	29	15	21	31
To what extent are average cost analyses appropriate for your purposes?	8	54	7	51	26
To what extent would marginal cost analyses be appropriate for your purposes?	19	38	8	3	32
To what extent *would* fixed variable cost analyses be appropriate for your purposes?	16	23	19	3	39
To what extent is it appropriate to simulate *your* institution in terms of the instructive function as opposed to the research or public service function?	48	23	2	6	21
To what extent can you approximate actual faculty commitment to your institution based on contractual time commitments?	22	36	15	7	21
To what extent are deterministic (single-value) projections appropriate for your purposes?	5	36	12	17	29
Based on historical enrollment patterns, to what extent can student demand for instruction be approximated, utilizing the Induced Course Load Matrix concept?	33	37	4	6	21
To what extent can the factors represented by the key variables of RRPM be affected by the management of your institution?	16	44	8	0	32

RESPONDENT BASE:

Next, let us review the uses to which RRPM is being put by the current user population. Some 29% of the respondents indicated, to "great" or "some extent," that they were using RRPM to make future cost projections; 42% indicated that, to "great" or "some extent," RRPM was being used for historical cost analysis; and 38% indicated that RRPM was being used for current cost analysis. Only 5% indicated that RRPM was being used by organizational units for line item budget data, while 42% indicated, to either "great" or "some extent," that the program budget reports were being used, which indicated discipline in department contributions to instruction programs.

Those who have criticized the conceptual design of RRPM have indicated two major concerns: (1) a need to include marginal costing capability, and (2) a need to include fixed variable costing capabilities. Of those who are currently utilizing RRPM, 57% indicated, either to "great" or "some extent," that marginal costing analysis would be appropriate for their purposes. Only 39% indicated that fixed variable cost analysis (either to "great" or "some extent") would be appropriate for their purposes.

CHAPTER VII

IMPLICATIONS OF THE FINDINGS OF THIS STUDY TO NCHEMS DISSEMINATION STRATEGY

In the previous chapters we have addressed the impacts of NCHEMS products and the individual and organizational context which influences the benefits derived from the use of such products. We have explored issues related to the questions of this study including:

- Who uses the products/concepts;
- Patterns of product evaluation, trial, and adoption;
- Why the products are used, how, and what benefits; and
- The validity of the assumptions included in the models.

These questions address the requirements of the study.

In this concluding chapter we wish to explore the following implications to the above findings with respect to the NCHEMS dissemination strategy:

- Reconciled normative and descriptive decision theory for educational institutions through combining the basic research and dissemination activities of the Center;
- Affirmation that the NCHEMS dissemination strategy primarily focuses upon disseminating concepts and that products are tools for disseminating concepts; and
- Identifying and addressing the planning and management needs of postsecondary education and its supporting infrastructure through establishing client/service linkages.

Each of these points is reviewed below.

A. RECONCILED NORMATIVE AND DESCRIPTIVE DECISION THEORY THROUGH COMBINING THE BASIC RESEARCH AND DISSEMINATION ACTIVITIES OF NCHEMS

The conceptual framework for the quantitative approaches to decision-making utilized in this study was found to be accepted — to some degree — in practice. However, it was also found that there are other forces external to the decision-making bodies, which also influence decision-making. NCHEMS tools have been developed under an assumption that quantitative approaches to management, based upon assumptions of how decisions "ought to be made," lead to greater organizational effectiveness and efficiency. This assumption is shared by many others who have sought to improve the management of educational institutions (Balderson). On the other hand, other organizational theorists have questioned these assumptions of rationality and proposed that other assumptions of decision-making offer greater explanatory value for evidence of how decisions are "actually" made (March and Olsen). These positions represent two points of view. Still others have suggested that a synthesis of these two assumptions is perhaps a more appropriate research direction for understanding the decision-making processes of organizations, in general, and educational institutions, in particular (Bauer; Paine and Naunes; and Rodgers). We recom-

mend that NCHEMS consider seeking a reconciliation of normative and descriptive decision theory through an integration of its basic research and dissemination activities. Such a reconciliation will require a change in emphasis of approach for NCHEMS activities.

First, we believe that it is essential that the NCHEMS research and development staff have direct opportunity for interaction with intended clients of the products. Technical assistance in training activities provides services to potential clients, while performing an essential function related to basic research — providing an open feedback loop between the users of the products and those responsible for the basic and implied research for the development of the products. We at Arthur D. Little find this interaction an essential part of our work in providing assistance to clients in the use of quantitative methods. The legal and policy issues which currently inhibit this interaction between the NCHEMS staff and clients should be explored and remedies sought which fall within the corporate charter of NCHEMS.

Second, there has been a shift in emphasis with respect to the planning and management functions. External reporting, evaluation, and analysis have been assessed as being less important to institutions in the future than resource allocation and strategic planning functions. In the past, NCHEMS focused primarily upon tools with respect to management control processes — primarily resource allocation and external reporting/evaluation/analysis. In the future, we believe that it will be important for NCHEMS to develop processes and capabilities for assisting institutions in undertaking strategic planning processes. Such assistance will take the form of a different product than that of the past. Quantitative tools are an important element of strategic planning, but there is a more comprehensive planning process, which has to be designed specifically for each environment. This is the basic substance of strategic planning.

By seeking a shift in emphasis that includes strategic planning and management control processes, we believe that NCHEMS will have a better opportunity of effecting this reconciliation between normative and descriptive decision theory. Furthermore, we believe that NCHEMS should recognize the essential function played by coordinating/governing boards in the planning and management function of institutions which are relevant to the use of NCHEMS products. Strategic planning and management control processes require Board approval. Governing boards are at the legal and fiduciary agents of institutions. We suggest that a new segmentation of intended clients be developed other than institutional and state-wide. These two distinctions camouflage the important role of central and systems offices which are primarily institutional in perspective but often state-wide in their jurisdictional authority. Better understanding of the coordinating and governing board environment is required to more effectively understand the strategic planning and management control processes of educational institutions.

B. AFFIRMATION THAT THE NCHEMS DISSEMINATION STRATEGY IS TO DISSEMINATE CONCEPTS AND NOT PRODUCTS

NCHEMS' dissemination strategy is predicated on the assumption of disseminating concepts, or knowledge, with respect to the improvement of the planning and management function of postsecondary education institutions. We believe that the dissemination strategy should be so affirmed that its emphasis is upon disseminating concepts or knowledge and not products, and that NCHEMS should assess its performance with respect to concept dissemination. These concepts, in general, are with respect to improving the planning and management of postsecondary education. Institutions can utilize the concepts without having to utilize the products.

Of course, such an affirmation presents an assessment problem. Based upon the results of this study, we believe that it is possible to assess the performance of NCHEMS with respect to concept dissemination as opposed to limiting such assessments primarily to a more finite and measurable notion of product distribution.

With an affirmation of the emphasis on concept dissemination, there should perhaps be a modification to the structure or "packaging" of product design to disseminate concepts. The intended audience for the products should be more clearly specified with an assessment function of the needs which the product is addressing. More emphasis should be placed on formulating a general design of the products. Indicating the concepts included in the products — and the intended purposes for which the products are developed — would aid clients in evaluating the product for their use. Next, functional or performance specifications of the tool should be developed, as well as an appropriate level of detail which would permit intended clients to develop their own tools if they chose to do so. The functional specifications would also be of assistance to clients in evaluating the appropriateness of the concept and the tools for their intended purposes. Finally, tools should continue to be developed so that they can facilitate trial use, and adapted to specific client situations. However, such a modification will probably have to be undertaken by the clients. The tools will be developed on a "nucleus" concept — a concept in which the tools can be used to form a nucleus of a modified product determined to be more appropriate for the purposes of specific client situations.

In terms of strategic planning products, a different concept of the product is required than that which relates to management control processes. Clearly, quantitative tools form an essential element of strategic planning. However, the tools support a more comprehensive institutional planning process to "decide on objectives of the organization, on changes in those objectives, on the resources used to obtain those objectives, and on the policies that are to govern the acquisition, use, and disposition of those resources. Strategic planning — is a process having to do with the formulation of long-range, strategic plans and policies that determine or change the character or direction of the organization" (Anthony and Hertzinger).

For example, the product for strategic planning would include greater specification of the concepts, a procedure to assist institutions in the formation of their own strategic planning process, and analytic tools necessary to support the variety of information required in strategic planning processes. The NCHEMS staff should be available to provide technical assistance and training to clients.

C. IDENTIFYING AND ADDRESSING THE PLANNING AND MANAGEMENT NEEDS OF POSTSECONDARY EDUCATION AND ITS SUPPORTING INFRASTRUCTURE THROUGH ESTABLISHING CLIENT/SERVICE LINKAGES

The results of the Phase I screening survey are of significant importance to our research design for developing a more comprehensive NCHEMS product/concept assessment strategy. Before reviewing the proposed strategy, we would like to summarize the objectives of the study and the context within which the study is being conducted. As presented in the initial Request for Proposal, the objective of this study is to examine how certain post-secondary education management tasks are performed at a number of institutions which utilize selected NCHEMS products. Two important factors that would affect the study were noted.

First, NCHEMS and its products are embedded within a larger arena of quantitative approaches to postsecondary education management. Many questions and concerns are being raised about the current and future impacts — both positive and negative — of quantitative management approaches upon postsecondary education, and whether indeed they offer any benefits. The complexity of the postsecondary education management environment and the diversity of quantitative approaches themselves give rise to a multiplicity of evaluation issues. Quantitative approaches are only one aspect of the many different techniques and resources available to higher education managers. It was expected that this NCHEMS product impact study would contribute toward further knowledge in this area.

Second, previous work that has been done in evaluating NCHEMS and its products should be assessed. The studies conducted by Heim and Plourde, for example, were noted. Other relevant work which we have discovered through our literature research and investigation includes studies by Schroeder and others. In analyzing these studies, Arthur D. Little concurs with the assessment indicated in the RFP that these investigations were limited to perceptions and reports of what happened. There was very little attention given to why certain impacts occurred within an accepted conceptual framework of organizational and decision-making behavior. Furthermore, there was little to no attention addressed to the implications of research relating to what could or should be changed in future NCHEMS work.

It was expected that this study would take at least one step toward improving this latter type of understanding. This expectation was fully corroborated by the staff of NIE in making its proposal to the legal council of NIE and requesting and gaining an opinion that the interviewing in this study did not require OMB forms clearance because the results of the study would be utilized to improve products developed by a federal contractor (i.e., NCHEMS).

During the course of the Phase I and II studies, we modified the research design presented in the proposal based upon information which was gained through our initial investigations. Our proposal assumed that the sample to be utilized in the study was to be provided by NCHEMS. The reasons why we made such a recommendation are presented in Chapter II of this report. Furthermore, our telephone screening survey was a national sample of the collegiate sector with respect to product awareness, product use and concept awareness. Our instrumentation for both the screening survey and the on-site survey for the 126 user institutions is predicated upon the assumption that the five NCHEMS products included in this study are actually dissemination tools of concepts — knowledge of quantitative approaches to the management of postsecondary education. We further agreed to do this proportionate sampling based upon identified product use for the 126 institutions to be included in the on-site interviews.

Based upon the results of the telephone screening survey, there is disproportionate representation of NCHEMS' users according to three segments by type and control taxonomy (i.e., public universities, and four-year institutions and private universities). There is underrepresentation with respect to two-year institutions, both public and private and four-year private institutions. In addition, there is underrepresentation of institutions with enrollments under 2,000 when compared to their representation in the entire collegiate sector. This underrepresentation in the NCHEMS user population has resulted in "unintended" market segmentation inconsistent with NCHEMS stated mission.

Because of a taxonomy and coding discrepancy and the way that we directed the telephone staff, approximately 50 central and systems offices were included in the Phase I telephone screening survey. Although there may be a bias in terms of how the sample was picked, it appears that central and systems offices (approximately 150) are making use of the products included in the study, even though these products were initially designed as institutional products. Therefore, according to our taxonomy of planning and management functions the constitutional authority of central and systems offices indicates that they would be actively involved in many of the key planning and management functions of interest in the use of the NCHEMS products included in this study, particularly strategic planning, and resource acquisition and allocation and evaluation and analysis functions. Therefore, because of the disproportionate sampling based on product use and the incompleteness of the unit of analysis, we are proposing a more comprehensive research approach within the broad general umbrella of the objectives and context within which Phases I and II of this study have been conducted.

We have reviewed the proposed modification with the Implementation and Evaluation Committee on January 29, 1978 and the following five alternatives for modification of the research design were identified as presented in Figure VII-1:

- An assessment of the planning and management functions and uses of the NCHEMS products included in this study by central and system offices;
- An assessment of the planning and management functions and use of the products included in this study of coordinating and governing boards (includes the above study);
- An assessment of the planning and management functions and needs of non-NCHEMS users in the collegiate sector;
- An assessment of the planning and management functions and needs of the occupational and vocational sector; and
- Establishment of a longitudinal dimension for our continued assessment of NCHEMS activities.

In reviewing these issues with members of the Implementation and Evaluation Committee of the NCHEMS Board of Directors and the NIE project monitors, we agreed that these modifications to the research design were within the objectives and context of this product impact study.

Note that Phases I and II have been completed during 1977-1978. The study of non-users of NCHEMS products is being undertaken in 1978-79. The other remaining studies remain for future research. Collectively, these studies represent a more comprehensive product/concept assessment strategy. This assessment strategy is more suitable for providing policy-relevant and practically useful information for chartering the future course of NCHEMS.

FIGURE VII–1

NATIONAL CENTER FOR HIGHER EDUCATION MANAGEMENT SYSTEMS
PRODUCT/CONCEPT ASSESSMENT STRATEGY

Objective of the Study	**Examine how certain postsecondary education management tasks are performed at a number of institutions which utilize selected NCHEMS products**						
Objectives of Each Phase of the Study	Phase I – National screening survey of collegiate sector to determine product awareness and use, and concept awareness	Phase II – On-site interviews at 125 institutions and branches which have ever used one or more of the five products included in the study to investigate issues of product/concept interest, evaluation, trial, and adoption	Phase III – Examine how planning and management tasks are performed by Governing Boards (institutions; central; and system offices); and assess current practices and future needs	Phase IV – Examine how planning and management tasks are performed by coordinating Governing Boards (includes Phase III plus state-wide agencies); and assess current practices and future needs	Phase V – Collegiate sector-non-NCHEMS users	Phase VI – Occupational/vocational sector – non-NCHEMS users	Phase VII – Longitudinal studies of any or all previous studies
Relationship of Each Phase to Overall Context of Study							
– **Current Use and Benefits Derived from Using Quantitative Approaches to Management**	Assessed product awareness and use concept awareness for collegiate sector	Assessed processes of product evaluation, trial, and adoption; and influences of individual perspectives and organizational context	• Current users of NCHEMS products designed for institutional use • High rate of use of quantitative tools; both NCHEMS and others	• Current users of NCHEMS products designed for institutional use • High rate of use of quantitative tools; both NCHEMS and others	• 42% of collegiate sector do not use any computer-based analytical tools • 28% of collegiate sector uses tools other than NCHEMS • determine planning and management needs	• Significant part of providers of post-secondary education services • Institutional-based planning and management needs not addressed by NCHEMS products included in this study • Major issue with coordinating/ Governing Boards	Determine factors which best maximize realization of concept awareness
– **Implication of Findings to Future NCHEMS Research, Development, Dissemination, and Evaluation**	Principal propensity to use quantitative tools is a function of complexity	• Assessed current practice and future needs • Assessed patterns of product use that maximize concept awareness • Assessed influence of contextual factors in product use and concept awareness	• Potential role of NCHEMS in future developments to meet a variety of current needs of Board members and staff • Establish client/service needs as opposed to developing products/ concepts based on deductive reasoning	• Potential role for NCHEMS in future developments to meet a variety of current needs of Board members and staff • Establish client/service needs as opposed to developing products/ concepts based on deductive reasoning	• Potential role for NCHEMS in future developments to meet a variety of current needs • Establish client/service needs as opposed to developing products/ concepts based on deductive reasoning	• Potential role of NCHEMS in future developments to meet a variety of current needs • Establish client/service needs as opposed to developing products/ concepts based on deductive reasoning	Opportunity to assess effectiveness of elected strategies as those strategies are being implemented
Interrelationships Between Objectives of Each Phase (Completed and Proposed) to Overall Objective of the Study, with respect to:							
Planning and Management Tasks	Not assessed	Defined taxonomy of planning and management tasks; assessed current practice and future needs	Governing Boards have/may have constitutional authority over planning and management tasks investigated in Phase II	Coordinating/Governing Boards have/ may have constitutional authority over planning and management tasks investigated in Phase II	Assess planning and management tasks – current practices and future needs with generalized definition of analytical tools	Assess planning and management tasks – current practices and future needs with generalized definition of analytical tools	Use taxonomy as defined (or subsequently modified)
Number of Institutions (or unit of Analysis)	Institutions and branches in collegiate sector (80 central, system offices and non-eligible institutions were included)	125 institutions and branches – uses of NCHEMS products	Governing Boards (single; multi-campus; and system)	Coordinating/Governing Boards (includes state-level agencies)	Defined as non-users in Phase I survey (institutions and branches)	Occupational/vocational sector – branches; – institutions; and – parent organizations	Consistent with previous definitions
Use of NCHEMS Products Included in This Study	AUPM; CADMS; IEP; RRPM; PCS	AUPM; CADMS; IEP; RRPM; PCS	CADMS; IEP; RRPM; PCS; suggest one additional	CADMS; IEP; RRPM; PCS; suggest one additional	No NCHEMS products included	No NCHEMS products included	Assess longitudinal use and benefits of selected products/concepts

Phases I and II completed.

Phase II is being conducted as Phase III.

Studies to be undertaken at some future date.

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APPENDIX A

APPENDIX A

THE SPECIAL RELATIONSHIP BETWEEN THE NATIONAL INSTITUTE OF EDUCATION AND THE NATIONAL CENTER FOR HIGHER EDUCATION MANAGEMENT SYSTEMS

The National Center for Higher Education Management Systems (NCHEMS) is an organization established to conduct research, development, dissemination, and evaluation activities and, as a national resource, to contribute to improved planning and management in postsecondary education. The Center, primarily funded by the National Institute of Education, extends its services to institutions and systems, state and federal agencies, and organizations in all sectors and at all levels of postsecondary education.

The long-range program plans and specific research and development projects that implement those plans in furtherance of the NCHEMS mission derive from policy and priority decisions made by the NCHEMS Board of Directors. The Board is broadly representative of the planning and management component of the postsecondary education enterprise. The objectives and priorities that it has determined for NCHEMS work in planning and management correspond closely to the objectives and priorities of NIE in the area of management, finance, and productivity. Partly because of this correspondence, a special institutional relationship has been eatablished between NCHEMS and NIE that will be supported by long-term funding from NIE.

This special relationship does not imply a change in the status of NCHEMS as an independent organization committed to responding to the needs of postsecondary education. The arrangement is based on the following assumptions:

1. The areas of concern designated by NCHEMS as "planning and management" and by NIE as "management, finance, and productivity" largely overlap and involve problems that are likely to endure for many years. Long-range activities, requiring research, development, dissemination, and evaluation, will be necessary to reduce these problems.
2. While the special relationship centers on NIE's program priority in the areas of postsecondary education finance, management, and productivity, other NIE program priorities relevant to the NCHEMS mission, role, and scope may be embraced by the special relationship.
3. The special relationship between NIE and NCHEMS will be planned and coordinated at the executive level. But it will include staff interaction in specific activities where cooperation at the operational level will be beneficial. When asked to do so, NCHEMS will participate in NIE's long-term planning in areas other than management, finance, and productivity.
4. In addressing these concerns, NCHEMS will undertake, as appropriate: (1) basic, applied, product, and implementation research; (2) a range of dissemination activities, including technical assistance and training; and (3) continuing internal evaluation, as well as periodic external evaluation of the impact of its activities and products on postsecondary education.

5. NCHEMS and NIE will collaborate to: (1) describe the state of the art in the area of postsecondary education management, finance, and productivity; (2) develop and maintain, through wide consultation, an agenda of priority research and development activities in this area; and (3) determine specific research and other activities that NCHEMS will perform in view of its special relationship with NIE.

6. In its leadership role as a national resource for the improvement of planning and management in postsecondary education, NCHEMS will: (1) undertake for NIE and other organizations specific studies appropriate to the Center's staff expertise and experience; (2) encourage its own staff and other researchers to engage in individual research projects, publications, and seminars, and facilitate visits by scholars and researchers to the Center; (3) cooperate with other researchers and research organizations in efforts to improve the effectiveness of educational research and development; and (4) from time to time, convene meetings of representatives of institutions, organizations, and agencies and others interested in management, finance, and productivity in postsecondary education to discuss issues of both immediate and long-range concern.

7. As a socially responsible institution, NCHEMS will effectively manage its affairs, keep its products and research findings in the public domain, and implement an effective Affirmative Action plan. NCHEMS will seek by every available practical means to increase the participation of minorities and women in educational research and development, particularly in the area of planning and management.

8. In order to sustain and improve upon its ability to perform work that meets the criterion of excellence that prevails in the postsecondary education community, NCHEMS will maintain a staff of high professional quality. In addition, through flexible staffing and consulting arrangements, NCHEMS will involve nationally recognized authorities in its work.

9. In view of NIE's responsibility to help establish a productive and efficient research and development system in postsecondary education and its specific interest in seeing the mission of NCHEMS accomplished, NIE will make every effort to provide the Center with basic long-term funding. Such funding will include resources for explorations into research problems of a conceptual nature or other ventures that involve high risk and long-term commitments. To help conserve NIE resources, NCHEMS will seek supplementary support from other sources, both public and private.

10. NCHEMS and NIE recognize that their research roles are not ends in themselves, but rather are intended to enhance the efficiency, effectiveness, and humaneness of the educational process and the value of its outcomes to both society and the individual.

11. NIE will respect the need for NCHEMS to act independently of NIE when necessary in order to meet the Center's responsibilities to its broad constituency in postsecondary education. For its part, NCHEM's recognizes that NIE is not to be held responsible for the success, viability, or failure of NCHEMS.

12. Not all of the assumptions underlying the special relationship between NIE and NCHEMS should be considered of equal merit and priority, or to be indefinitely in effect. These assumptions will serve as guidelines in implementing the special relationship accordingly as resources permit and the needs of a given time dictate.

APPENDIX B

A CHARACTERIZATION OF SELECTED PRODUCTS DEVELOPED BY THE NATIONAL CENTER FOR HIGHER EDUCATION MANAGEMENT SYSTEM

This appendix presents the results of our efforts to characterize the five NCHEMS products* selected for the impact study. In this characterization effort, we sought to develop background information about the underlying issues and assumptions of each product. Our purpose was two-fold: first, through a synthesis of the background information, to highlight, for actual and potential users, the underlying issues and assumptions; and second, to provide information to the research effort, by which the impacts on planning and management functions might be assessed.

During the process of characterizing the products we came to understand that their design was such that users could adapt them to meet specific needs or use the products in ways that might not have been anticipated by the designer. What we are reporting on, however, are the generally expected product use patterns.

In the sections which follow we discuss:

- the product characterization process;
- the underlying philosophical base for the products; and
- the underlying issues and assumptions for each product.

I. PRODUCT CHARACTERIZATION PROCESS

The process by which we gathered background information about the products involved a combination of a review of NCHEMS documents which describe the products and discussions with NCHEMS staff having responsibility for or familiarity with the products. The document review began with a scanning of more than 40 NCHEMS (and WICHE) reports and papers having to do with the five products. We next selected documents** which were most pertinent to the question of underlying issues and assumptions. These documents were then perused to develop more than a passing acquaintance with the products prior to discussions with NCHEMS staff.

The perusal of the selected NCHEMS documents led to a focusing on areas for discussion in the subsequent meetings with NCHEMS staff. For each of the five products we were prepared to discuss major topics and topics of lesser importance. The major topics included:

- parties-at-interest or target audiences at which a product was directed;
- issues being addressed including purpose(s), use(s), and desired or anticipated effect(s) of a product; and

*The five products are the Program Classification Structure (PCS), Information Exchange Procedures (IEP); the Resource Requirement Prediction Model (RRPM); the Costing and Data Management System; and the approach to Academic Unit Planning and Management (AUPM).

**These documents are listed in the bibliography.

- underlying assumptions about institutional structure, institutional and/or individual decision processes, and analytic methodologies.

Topics of lesser importance to our characterization of the five products (deemed because of the focus of this study) included analytic techniques and anticipated or actual pitfalls associated with the use of the techniques.

These topics served as the general agenda for discussions with NCHEMS staff. Table 1 presents the names of NCHEMS staff members interviewed relative to each product that we have investigated. These interviews were conducted by Mr. Thomas Renda, of Arthur D. Little, Inc., and Dr. Burton Wolfman, Dean of Administration at Radcliffe and consultant to Arthur D. Little, Inc.

Product	NCHEMS Staff
Program Classification Structure (PCS)	Dennis Jones and Doug Collier
Information Exchange Procedures (IEP)	Jim Topping, Nancy Renkiewicz, and Len Romney
Resource Requirements Prediction Model (RRPM), and Costing and Data Management System (CADMS)	Dick Johnson and Gary Gamso
Academic Unit Planning and Management (AUPM)	Ray Kieft

The above staff members were afforded an opportunity to review an earlier draft of this appendix, and their suggestions have been included.

II. UNDERLYING PHILOSOPHICAL BASE: AN OVERVIEW

During the review of NCHEMS reports and papers pertinent to the five products, we identified both explicit and implicit overriding assumptions which appear to be the motivating factors for NCHEMS activities. These assumptions were tested in our discussions with NCHEMS staff. To a large extent the discussions served to reinforce our impressions of the overriding assumptions as well as to augment our understanding of the motivating factors. The following list of overriding assumptions, which represent our understanding of the NCHEMS underlying philosophical base, has been derived both from our initial document review and from the subsequent discussions with NCHEMS staff.

- Post-secondary institution decision making, management, and planning are generally in need of improvement.
  - Improvement may be gained through the use of *structural frameworks* for information gathering and analysis.
  - Improvement may be gained through better and more *consistent* information and analysis.

  - Improvement may be gained by the *sharing of consistent information* brought about by structural mechanisms such as the NCHEMS products.
  - More *quantitative information* leads to better decision making.
- Normative models (i.e., how decision making, management, and planning ought to be) can be *deductively developed* and can help institutions in their management activities.

  Inductive processes (i.e., empirical data gathering, analysis, and synthesis) can be delayed until a product is field tested.
- The emphasis should be on a *macro-analytic or central administrative view* with regard to the gathering and analyzing of quantitative information. (An exception is AUPM.)
- The focus is on institutional *internal information of the present to the exclusion of external effects and uncertainties of the future* (e.g., economic, demographic, or student choice shifts).
- *Productivity* is the central evaluation measure with respect to institutional performance.

These overriding assumptions tend to be borne out by the product linkages brought out in our discussions with NCHEMS staff. With the exception of AUPM, the products under investigation are strongly linked in both a structural and use of information sense. Figure 1 shows the product linkages and the time sequence of product development. The four products to the left of the dotted line are sophistications or augmentations of one another with PCS having been developed first. AUPM is the only one of the five products which is not aimed at a central administrative activity of institutions and/or branches.

PCS itself is a normative structural framework which provides for consistency and the potential for the sharing of interinstitutional quantitative information. The focus is on central administrative information internal to an institution; the information is productivity oriented. RRPM, IEP and CADMS are basically variations and augmentations of the same theme. These products as well as PCS are discussed in more detail in the following sections.

III. PROGRAM CLASSIFICATION STRUCTURE (PCS)

The Program Classification Structure (PCS) is a means by which programs, rather than administrative or academic department units, can be planned and budgeted. A program is an aggregation of activities serving a common set of objectives. In PCS there are eight programs, three of which are primary institutional functions, and five of which are support functions. These functional programs are shown in Figure 2 which represents the relationship between programs and the more traditional organizational units. This means of depicting and aggregating such relationships takes its cues from the Program Planning and Budgeting System (PPBS) which came to preeminence in the early 1960's in Department of Defense Planning and Budgeting. PPBS is a system aimed at the development of organization-wide objectives; the design of programs in pursuit of those objectives; and the determination of costs associated with the conduct of such programs.

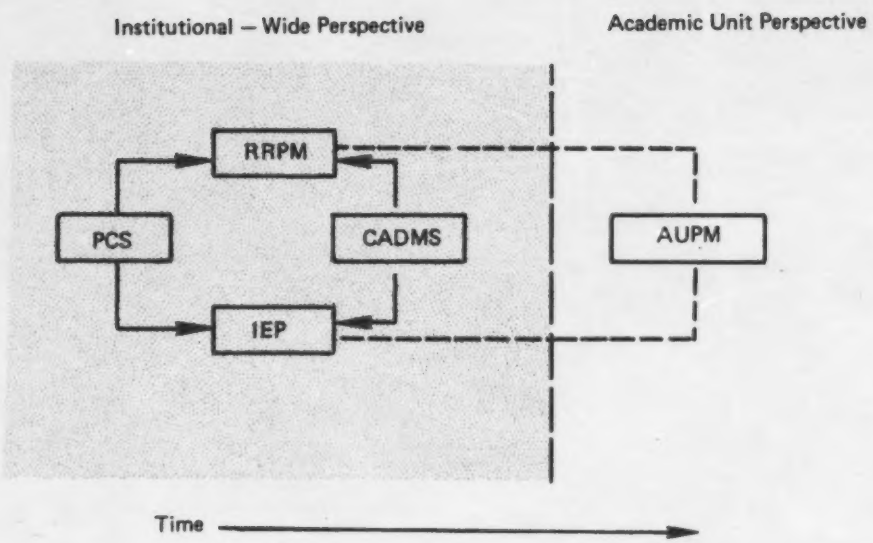

FIGURE 1 PRODUCT LINKAGES AND DEVELOPMENT SEQUENCES FOR PRODUCTS INCLUDED IN THIS STUDY

NCHEMS Program Classifications	Institution Organizational Units							
	Academic Departments				Administrative Activities			
Primary Programs	1	2	...	n	1	2	...	n
Instruction								
Research								
Public Service								
Support Programs								
Academic Support								
Student Service								
Institutional Support								
Independent Operations								
Student Access								

FIGURE 2 RELATIONSHIPS BETWEEN NCHEMS PROGRAM CLASSIFICATIONS AND ORGANIZATION STRUCTURE OF EDUCATIONAL INSTITUTIONS

A. PCS Audience

The impetus for developing PCS came from the expressed needs of eleven western post-secondary institutions. PCS, however, has been broadened to be national in scope and has been adapted by several federal and state agencies and coordinating and governing boards. Originally, the product was directed toward planning managers and planning technicians in higher education institutions. More recently state funding agencies and legislatures have become important parties-at-interest.

B. Issues Being Addressed by PCS: Purposes, Uses, and Desired Effects

Beyond providing a framework for program planning and budgeting, a primary purpose of PCS is to facilitate the flow of intrainstitutional and interinstitutional information. PCS is expected to facilitate information flow through its structure, data consistency, and data integration. By facilitating intra- and interinstitutional information flows, this program budgeting prototype is intended to lend itself to comparative analysis which can be of assistance in resource allocation and acquisition activities, and in meeting accountability requirements.

Upon its application, by focusing on institution-wide objectives, PCS may be used to provide a common structure for the disparate management activities including finance, personnel, and facilities management.

C. PCS Underlying Assumptions (About Decision Processes, Institutional Structure, and Analytic Methodologies)

In addressing the issues, the developers of PCS made several assumptions about institutional decision processes and needs, structure, and analytic methodologies. These assumptions are listed below:

- There is a commonality of objectives and programs among a majority of institutions, thereby making interinstitutional information sharing feasible.
- There is a need and desire for objectives-oriented central decision making.
- The exchange of information within or outside of an institution requires a prescribed structure and common language.
- The separation of program functions is possible (e.g., instruction compared to research, public service compared to central administration).

D. NCHEMS Staff Retrospective Appraisal of PCS

In discussing PCS with NCHEMS staff we were afforded some retrospective appraisals.

- Many institutions engage in or utilize the concepts of program planning and budgeting, but do not recognize that they may be using PCS.

- There has been some difficulty in keeping the product abreast of real world changes (e.g., changes in institutional functional programs or in relationships with funding agencies) particularly because some user institutions which focus on information sharing want to maintain a status quo.
- The use of PCS may now be more a function of external (Federal and state government) reporting requirements than institutional planning and management requirements.

IV. INFORMATION EXCHANGE PROCEDURES (IEP)

The Information Exchange Procedures (IEP) is a set of standard definitions and procedures for collecting information about disciplines and student degree programs, outcomes of instructional programs, and general institutional characteristics. As such it is based in large part on the Program Classification Structure (PCS). However, it extends beyond PCS in that its primary focus is on comparative analysis rather than on the forerunner activity of program planning and budgeting. Comparative analysis, in the IEP context, is both intra- and interinstitutional. The intrainstitutional (or longitudinal) analysis is of a set of data about the same institution over a series of points in time. Interinstitutional (or cross-sectional) analysis is of the same set of data about each one of a group of institutions. The data set includes historical measures of costs, outcomes, and other institutional characteristics, including numbers and types of students, resources, and program activities.

A. IEP Audience

The impetus for developing IEP came from a group of institutions in the western states and from institutions in Illinois and New York. These institutions were interested in developing a capability for comparative analysis through information exchange.

The product developed by NCHEMS, which was originally directed at central administrators of participating institutions, has drawn the interest of and use by state funding agencies and legislatures.

B. Issues Being Addressed by IEP: Purposes, Uses, and Desired Effects

In its most general sense the purpose of IEP is to support institutional identification, acquisition, and use of information necessary to carry out *interinstitutional comparative analysis*, particularly with respect to resource allocation. More specifically, it is aimed at the exchange and reporting of financial and other information necessary to *calculate and evaluate costs* by discipline and course level; student major field and student level; and per unit of output.

Beyond the ultimate measure of cost per unit of output, IEP is to be used to provide improved information (both quantity and quality) which institutions can bring to bear on their internal planning and management problems. An additional use is in assisting institutions in meeting their various reporting responsibilities.

In addition to easing the accountability pressures placed on institutions by Federal and state agencies, the developers of IEP sought to introduce a quantitative style of management. Moreover, a desired effect was a conceptual change toward a managerial philosophy which is based upon evaluating the outcomes of higher education rather than on inputs or consumption of resources.

C. IEP Underlying Assumptions

The list of underlying assumptions which follows, stems both from our review of the NCHEMS documents which describe IEP and from discussions with NCHEMS staff.

- Comparative analysis (either intra- or interinstitutional) is valid and valuable.
- Data comparability can be achieved by establishing a fixed structure and data definitions, and recommending a set of procedures for data collection and exchange.
- Knowing its relative standing among institutions is important to an institution.
- Information exchange is better accomplished through a formal procedure than through informal processes.
- Institutional decision processes can be improved through a higher level of quantification.
- Institutions may be grouped according to institutional structure or curricula.

These assumptions seem to ignore possible undesirable effects of comparative analysis including the possibility of intruding on an institution's own planning or management activities. They further avoid complications arising from differences in institutional objectives. Moreover, in their totality, they assume the validity of time series analysis which doesn't account for external effects.

D. NCHEMS Staff Retrospective Appraisal of IEP

In their review of the outcomes of IEP, NCHEMS staff indicated that they have observed some unanticipated positive effects. First, the desire to use IEP has caused some institutions to change and improve their data systems to meet the product's requirements. Second, the structure of IEP has led to a better integration of administrative offices in some institutions.

On the other hand, IEP has not been implemented without difficulty and possibly undesirable effects. According to NCHEMS staff the process of information exchange has been difficult. Implementation and operation are highly dependent on the continued presence of an implementer. As a generalized model, IEP has not been cost effective and is therefore usually undertaken as a one time effort. Finally, its use has become more a function of state government accountability requirements than a function of institutions' desires to improve planning and management through the sharing of information.

V. RESOURCE REQUIREMENTS PREDICTION MODEL (RRPM)

A natural complement to PCS and IEP is the Resource Requirements Prediction Model (RRPM), a cost simulation model which primarily focuses on instruction resource requirements, and is fundamentally directed at programs (as in PCS) rather than administrative or departmental units. Through the use of the model an institution can develop and utilize both program (across departments) budget reports and organizational unit reports.

The model involves six phases.

- A *characterization* of the organization in terms of institutional definitions
  - organization levels (e.g., academic department)
  - course levels (e.g., sophomore)
  - student levels (e.g., freshman)
  - instruction types (e.g., lecture, laboratory)
  - faculty ranks (e.g., instructor)
  - staff categories (e.g., secretary)
  - other expense items (e.g., travel, equipment).
- An estimate of *demand* in terms of credit hours of demand placed on programs and teaching departments.
- A calculation of *supply* in terms of full-time equivalent (FTE) instructional faculty and salaries.
- A calculation, on an allocation basis, of *discipline costs* other than faculty salaries (e.g., libraries).
- A calculation of *costs (support)* other than general academic instruction.
- Preparation of budget and cost *reports*.

A. RRPM Audience

The cost simulation model is directed at central administration financial planners and analysts in both large and small universities. As with PCS and IEP, other parties interested in RRPM include funding agencies.

B. Issues Being Addressed by RRPM

Originally, RRPM had as its intended purpose the providing of assistance to financial planners in their resource acquisition activities. Now that the age of institutional growth has been passed, an emerging purpose of RRPM is in providing a methodology for the redistribution of resources.

Uses of the model include cost projections and the development of historical perspectives for institution planners. Beyond the desired effect of projecting costs, the model is intended to serve as a basis for discussion among parties at interest within

and outside of the institution. For instance, it is intended to be used to bring to a resource allocation discussion some "what if" questions concerning admissions policies and implications of curricula changes.

C. RRPM Underlying Assumptions

In general the assumptions associated with PCS and IEP are pertinent to RRPM. Additionally, to make the model operational the developers had to make some specific assumptions.

- A *typical* student in a field of study could be described in terms of *average* credit hours (or other institutionally appropriate units) taken.
- The *credit hour* is the common unit of demand and supply measurement.
- Faculty members *teach exclusively in one level;* or the amount of their teaching responsibilities can be allocated to institutionally defined levels of instruction.
- *Instruction,* rather than, for instance, research, is the focus of resource acquisition and distribution.
- *Production* is measured by an institutionally defined measure which is knowledge-based; as opposed to skill or competency-based.
- Derived cost ratios may be (and are) comparable interdepartmentally.

D. NCHEMS Staff Retrospective Appraisal of RRPM

There was little in the way of retrospective appraisal in our discussions with NCHEMS staff.

VI. COSTING AND DATA MANAGEMENT SYSTEM (CADMS)

The Costing and Data Management System (CADMS) is basically a data processing system in support of other NCHEMS products including IEP and RRPM. Its purpose is to assist institutions in the implementation of cost studies, both historical (cost study portion of IEP) and predictive (RRPM). Five sets of input data may be provided, including student registration; student outcomes; personnel; faculty activity; and accounting information. Users have the option of using one or more of the program modules.

Because CADMS is primarily designed to facilitate the data definition and processing aspects of RRPM and IEP, its assumptions relevant to planning and management functions are similar to those presented above for PCS, IEP, and RRPM.

VII. ACADEMIC UNIT PLANNING AND MANAGEMENT (AUPM)

Academic Unit Planning and Management (AUPM) is an NCHEMS product which is philosophically different from the other NCHEMS products being investigated in this study. Whereas the basic unit of application for the other products is

at the central administrative level, the AUPM basic unit of application is the academic department. Operationally, however, AUPM rests upon the same conceptual foundations as the others in that its focus is on systematic, quantitative data gathering and analysis.

The AUPM model of academic unit planning and management encompasses six modules.

- Identifying and organizing academic unit *functions* and *faculty plans.* (Structures Module)
- Examining academic *demand* including interrelationships of student demand at the institutional and academic unit levels; identification of instructional and noninstructional demand; historical patterns of enrollment; and computation of credit hours demanded by students from each department and for each course within a department. (Academic Demand Module)
- Planning faculty *resources* by using the first two modules to assess availability of faculty and identify tentative assignments. (Faculty Resource Module)
- Planning *physical resources* requirements including rooms, supplies, and equipment. (Physical Resource Module)
- Planning financial resources through a source and use of funds analysis. (Finance Module)
- Identifying and assessing outcomes in terms of objectives (goals); variables (outcome components); and measures (of components). (Outcomes Module)

A. AUPM Audience and Issues Being Addressed

AUPM, which was championed by one former member of the NCHEMS staff, is directed at an audience which had been ignored (by the other products) in favor of central administrators and technical staff; this audience is the faculty and faculty leadership (e.g., department chairmen). This product was therefore developed to provide a management aid for faculty leaders in terms of identifying planning and management factors, and providing the means for analysis and communication. It further recognizes and attempts to deal with the problems of academic units which are constrained by factors external to the department (e.g., the institution itself).

B. AUPM Underlying Assumptions

The basic explicit and implicit assumptions underlying AUPM follow:

- Systematic planning within an academic unit is a prerequisite to improving academic unit planning and managing.
  - There is the need to replace intuition and judgment through systematic data gathering and analysis.

— Systematic planning is brought about by planning and managing the specific aspects of a unit's operations including its functions; the demands placed upon it; its resources; and its outcomes (or the synthesis of demands and resources).

- The inclusion of faculty in institutional planning and managing would naturally result from an institution's structure and decision processes, and from its prior use of other NCHEMS products.
- A dispassionate (calculated) matching of faculty capabilities to demand requirements is possible and desirable.
- The most important measure of academic unit performance is the matching of demand and supply.

C. NCHEMS Staff Retrospective Appraisal of AUPM

NCHEMS staff, who were not involved in the development of AUPM, indicated that the field testing of the product had not met with a high degree of success. Academic unit department chairmen and other users have indicated that AUPM is too quantitative and that there is hesitancy in using the product because of uncertainty as to how it fits into and will be used by other institutional administrators.

We were not able to review the results of the implementation of AUPM with staff involved because the two staff members associated with the products development are no longer with the center.

Program Classification Structure (PCS)

Collier, Douglas. *Concepts and uses of the Program Classification Structure.* August 1977.

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Huff, Robert A. *WICHE MIS Program Classification Structure Explanation and Illustration.* September 22, 1969.

Miyataki, Glenn. *Summary of Program Classification Structure Comments.* January 18, 1971.

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University of California. *An Evaluation of the WICHE Program Classification Structure.* November 1, 1970.

Venieris, John P. and Horne, Boyd W. *An Evaluation of the WICHE Program Classification Structure for use by the California State Colleges. A Report to the Joint Legislative Budget Committee.* November 18, 1970.

Information Exchange Procedures (IEP)

Byers, Maureen and Bower, Cathleen. *IEP Analysis and use: Single-Institution Data Field Review Edition Technical Report No. 73.* NCHEMS at WICHE. June 1975.

Gamso, Gary S. and Service, Allan L. *Introduction to Information Exchange Procedures: A Guide for the Project Manager. Technical Report No. 76.* NCHEMS at WICHE. March 1976.

Myers, Edward M. and Topping, James R. *Information Exchange Procedures Activity Structure Technical Report No. 63.* NCHEMS at WICHE. 1974.

Romney, Leonard C. *Information Exchange Procedures: Overview and General Approach. A Synopsis. A Field Review Edition.* NCHEMS at WICHE. September 1972.

Topping, James R. *IEP Definition: Issues and Discussion.* November 1975.

Resource Requirements Prediction Model (RRPM)

Clark, David G., et al. *Introduction to the Resource Requirement Prediction Model 1.6 Technical Report No. 34A.* NCHEMS at WICHE. 1973.

Gamso, Gary. *The RRPM Guide: A Primer for using the NCHEMS Resource Requirements Prediction Model (RRPM 1.6). NCHEMS Technical Report 104.* NCHEMS. August 1977.

Outcomes of the RRPM-1 Task Force Meeting. December 3, 1970. Western Interstate Commission for Higher Education Planning and Management Systems Division.

Outcomes of the RRPM-1 Task Force Meeting. March 4-5, 1971. Western Interstate Commission for Higher Education Planning and Management Systems Division. University of Utah, Salt Lake City.

Outcomes of RRPM-1 Task Force Meeting. June 23-25, 1971. Western Interstate Commission for Higher Education Planning and Management Systems Division. Palo Alto, California.

——. *Resource Requirements Prediction Model 1.6 Reports. Technical Report 34B.* NCHEMS at WICHE. 1973.

Clark, David G., et al. *Introduction to the Resource Requirements Prediction Model 1.6. Technical Report No. 34A.* NCHEMS at WICHE. 1973.

Gamso, Gary. *The RRPM Guide: A Primer for using the NCHEMS Resource Requirements Prediction Model (RRPM 1.6). NCHEMS Technical Report 104.* NCHEMS. August 1977.

Costing and Data Management System (CADMS)

Haight, Mike and Martin, Ron. *An Introduction to the NCHEMS Costing and Data Management System. Technical Report No. 55.* NCHEMS at WICHE. January 1975.

Academic Unit Planning and Management (AUPM)

Miyataki, Glenn K. and Byers, Maureen L. *Academic Unit Planning and Management. Technical Report 75.* NCHEMS at WICHE. January 1976.

Miyataki, Glenn K. and Gray, Robert G. *Academic Unit Planning Manual. Field Review Edition. Technical Report No. 72.* NCHEMS at WICHE. January 1975.

Miyataki, Glenn K. *Intra-Instructional Planning and Management (IIPM) Project: Pilot Test Plan for the ACADEMIC UNIT PLANNING MANUAL.* NCHEMS. May 1975.

APPENDIX C

FICE # _____

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110277

Hello, this is _____, calling from Opinion Research Corporation.

May I speak to _____?

> If designated respondent is not available, find out when he/she will be and call back at that time.
>
> If designated respondent will not be available during the interviewing period, see instructions for choosing an alternate.

We are conducting a study for NCHEMS, the National Center for Higher Education Management Systems. I have a few questions I would like to ask you. It should take less than five minutes.

1. First, we would like to know which of certain NCHEMS products you have heard of. The first is the . . .

	Q. 1		Q. 2	
	HEARD OF	HAVE NOT	USED	HAVE NOT
Academic Unit Planning and Management, called AUPM	1	2	1	2
Costing and Data Management System, or CADMS	1	2	1	2
Information Exchange Procedures, or IEP	1	2	1	2
Resource Requirements Prediction Model, or RRPM	1	2	1	2
Program Classification Structure, or PCS	1	2	1	2

IF HEARD OF ANY, ASK Q. 2. OTHERWISE SKIP TO Q. 4.

2. As I read the names of the products again, please tell me whether or not your institution has ever used that product.

IF PCS USED ON Q. 2, ASK:

3. Some institutions use PCS only for external reporting, such as to HEGIS, while others also use it for internal analysis. Does your institution use it only for external reporting, or also for internal analysis?

1 EXTERNAL ONLY
2 INTERNAL ALSO
3 OTHER ANSWER (Specify)

_____

_____

4. Have you used any computer-based analytical management tools other than NCHEMS products?

1 YES
2 NO → GO TO Q. 5

IF "YES" ON Q. 4, ASK:

4a. Were they developed by the staff of your institution or purchased or acquired from an external service?

1 DEVELOPED BY STAFF OF INSTITUTION
2 PURCHASED OR ACQUIRED FROM EXTERNAL SERVICE

5. The next questions are about the use of management analytical tools generally. There is a premise that management of a post-secondary institution can be improved through analytical tools whose use brings about changes in attitudes, understanding, and emphasis on the part of decision-makers. In your opinion, have your decision-makers changed in their attitudes, understanding, and emphasis through the use of analytical tools?

1 YES
2 NO
3 DON'T KNOW

6. How would you characterize the decision-making process in your institution? To what extent have the following benefits been derived?

	GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
First, a. Recognition of the importance of data in decision-making. Has this happened to a great extent, to some extent, very little, or to no extent?	4	3	2	1	0
Next, b. Generation of alternatives for evaluation by decision-makers.	4	3	2	1	0
c. Importance of understanding relationships with forces outside the institution and changes in these relationships	4	3	2	1	0
d. Better understanding of interdependence of various units of the institution.	4	3	2	1	0
e. Ability to better define problems.	4	3	2	1	0

CHECK BACK TO Q. 2. If respondent has used any of the first four products listed, or if has used only PCS but has used it for internal purposes, say:

Thank you. We will be getting back to a sample of institutions that use NCHEMS, so we may be calling you for an appointment in a month or so.

If respondent has not used any of the products, or has used only PCS and only for external purposes, say:

Thank you. That concludes the interview.

APPENDIX D

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FORM A

NCHEMS STUDY

FICE CODE

INTRODUCTION:

As we discussed earlier, this study is concerned with the use of NCHEMS products in colleges and universities. We are talking to people in a sample of some 125 institutions across the country.

Your answers to these questions will be combined and analyzed with those of other similar institutions. They will be held in strict confidence and no individual data will be released that identifies your answers with your name or the name of your institution.

1. Before we start talking about NCHEMS products, I'd like to get your overall assessment of the greatest planning and management problems areas in the foreseeable future in your position at (INSTITUTION).

The next set of questions is about the use of management tools generally. Will you please circle the number alongside of each answer that best represents your opinion? (TURN PAGE. HAND RESPONDENT PENCIL AND QUESTIONNAIRE.)

Please circle the number next to the answers that are closest to your opinion.

2. There is a premise that management of a post-secondary institution can be improved through analytical tools whose use brings about changes in attitudes, understanding, and emphasis on the part of decision-makers. In your opinion, have your decision-makers changed in their attitudes, understanding, and emphasis through the use of analytical tools?

2 Yes
1 No
0 Don't know

3. How would you characterize the decision-making process in your institution? To what extent have the following benefits been derived? Please circle one number on each row.

	GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
a. Recognition of the importance of data in decision-making	4	3	2	1	0
b. Generation of alternatives for evaluation by decision-makers	4	3	2	1	0
c. Importance of understanding relationships with forces outside the institution and changes in these relationships	4	3	2	1	0
d. Better understanding of interdependence of various units of the institution	4	3	2	1	0
e. Ability to better define problems	4	3	2	1	0

(Please go to next page....)

4. Please indicate the extent to which, in your opinion, each of these things influence policy formation in your institution.

	GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
a. Internal staff analysis	4	3	2	1	0
b. Recommendations of faculty	4	3	2	1	0
c. Intuitive judgment of chief executive officer	4	3	2	1	0
d. Political pressures of external constituents (governing boards, alumni, etc.)	4	3	2	1	0
e. Funding agencies (foundations, state and federal agencies)	4	3	2	1	0
f. Information derived from quantitative tools (e.g., NCHEMS or other products)	4	3	2	1	0
g. Interpretation of raw data (such as enrollment figures, financial statements)	4	3	2	1	0
h. Collective bargaining agents	4	3	2	1	0

5. What other things, if any, influence decision-making in your institution?

_____

_____

_____

5a. Please indicate which staffs of your institution are unionized.

	YES	NO	DON'T KNOW
Faculty	3	2	1
Support Staff	3	2	1

(Please go to next page ...)

6. To what extent do you believe the following characteristics apply to planning at your institution?

	GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
a. Emphasis on interpersonal process rather than just the document/plan which is produced	4	3	2	1	0
b. Breadth of scope -- includes institution-wide issues	4	3	2	1	0
c. Integration of academic, financial, and facilities planning	4	3	2	1	0
d. Institutional priorities and commitments defined	4	3	2	1	0
e. Continuous, rather than ad hoc or sporadic activities	4	3	2	1	0
f. Uses research based on institutional data	4	3	2	1	0
g. Broad participation of relevant constituents such as faculty, administration, students, and members of the governing board	4	3	2	1	0

7. In the past few years, the role of professional manager in educational institutions has increased. There are many who view this trend with alarm, while others have been most supportive. We would like to know your own agreement with the following statements. Please circle one number for each statement.

	AGREE STRONGLY	AGREE MILDLY	DISAGREE MILDLY	DISAGREE STRONGLY
a. A personal understanding and experience in the education environment is essential for the successful application of management science and management tools in post-secondary education	4	3	2	1
b. Management science and management tools can be used successfully in post-secondary education without direct reference to the educational environment	4	3	2	1
c. Academic and institutional managers should have substantial academic careers before being appointed administrators	4	3	2	1

(Please go to next page ....)

8. What is the nature of the training you have had in administrative principles and procedures? Please circle as many as apply.

1 Terminal professional degree (Ph.D., Ed.D., D.B.A., etc.)
2 First professional degree (MBA, M.Ed., etc.)
3 Management seminars (few days)
4 Executive management program (few weeks)
5 Vocational/technical training
6 On the job training
7 Personal experience
8 Other (Please specify)_____

9. These statements concern the quality of data generally available to decision-makers in your institution. From your point of view, please indicate your degree of agreement with each of the statements by circling one number on each line.

	AGREE STRONGLY	AGREE MILDLY	DISAGREE MILDLY	DISAGREE STRONGLY
a. Data available for decision-makers are easy to understand	4	3	2	1
b. You can rely on the data available in your institution	4	3	2	1
c. Data made available to decision-makers release work pressure	4	3	2	1
d. Data are readily available when needed for decision-making	4	3	2	1
e. There are too much data available	4	3	2	1

10. How would you characterize your institution's budgeting process? Please circle as many as apply.

1 Planning
2 Line-item
3 Performance and/or Formula
4 Zero-based
5 Other (Please specify) _____

_____

11. To what extent do political negotiations influence your institution's budgeting?

1 Great extent
2 Some extent
3 Very little
4 No extent
5 No opinion

(Please go to next page ....)

12a. Is your budget prepared under assumptions of --

1 Centralized, or
2 Decentralized decision-making process?

12b. To what extent do you feel your institution is successful in managing scarce resources?

1 Great extent
2 Some extent
3 Very little
4 No extent
5 No opinion

PLEASE RETURN THE QUESTIONNAIRE TO YOUR INTERVIEWER.

13a. The next questions have to do with NCHEMS products. Here is a list of five different NCHEMS products.

SHOW EXHIBIT A

Using the answer categories printed on the exhibit, please tell me how familiar you are with each of these products. First, AUPM ...

	a. AUPM	b. CADMS	c. IEP	d. PCS	e. RRPM
Know the product very well	1	1	1	1	1
Fairly well	2	2	2	2	2
Heard of, know only a little about it	3	3	3	3	3
Never heard of	4	4	4	4	4

IF "NEVER HEARD OF" ANY OF THE PRODUCTS (4 IN EACH COLUMN), SAY:

"Thank you. That concludes the interview."

ASK ONLY OF THOSE WHO KNOW ANY PRODUCT VERY OR FAIRLY WELL.

SHOW EXHIBIT B

13b. Please indicate to what extent the following sources of information influenced your knowledge of these NCHEMS products.

	GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
a. Formal papers and presentations by NCHEMS staff and/or members of advisory structures representing NCHEMS	4	3	2	1	0
b. Published proceedings of meetings, seminars, and assemblies	4	3	2	1	0
c. User-oriented (overview) NCHEMS manuals about the products	4	3	2	1	0
d. Technical NCHEMS manuals about the products	4	3	2	1	0
e. Case study documentation on results/ benefits/problems in using NCHEMS products	4	3	2	1	0
f. NCHEMS training and dissemination seminars	4	3	2	1	0
g. Referrals from others who have used the products	4	3	2	1	0
h. Other sources (please specify) _____	4	3	2	1	0

TAKE BACK EXHIBIT B; SHOW EXHIBIT C

14. We are interested in knowing the NCHEMS products that are used in the planning and management functions in your institution. Here are some types of planning and management functions in which NCHEMS products are designed to play a role. Please take a minute to look over the functions as we've classified them.

Now, as I read each function, please tell me which, if any, of the five NCHEMS products are used for that function, and the extent of the relevance of the products to that function. More than one product may be used for a specific function. First, Constitutional/Statutory Authority Decisions ...

	Products Used							Relevance					
	NONE	AUPM CADMS		IEP		RRPM PCS	DK WHICH	GREAT EXT.	SOME	LITTLE	NO EXT.	NO OPIN.	NOT APPL.
a. Constitutional/ Statutory Authority Decisions	0	1	2	3	4	5	6	4	3	2	1	0	9
b. Strategic Planning	0	1	2	3	4	5	6	4	3	2	1	0	9
c. Resource Acquisition	0	1	2	3	4	5	6	4	3	2	1	0	9
d. Resource Allocation	0	1	2	3	4	5	6	4	3	2	1	0	9
e. Institutional and Management Control	0	1	2	3	4	5	6	4	3	2	1	0	9
f. Evaluation/ Reporting/ Analysis	0	1	2	3	4	5	6	4	3	2	1	0	9
g. Other (Specify) _____	0	1	2	3	4	5	6	4	3	2	1	0	9
_____													

INTERVIEWER: THERE MUST BE AT LEAST ONE NUMBER CIRCLED ON EACH LINE. IF R IS UNFAMILIAR OR NOT INVOLVED IN A FUNCTION, CIRCLE "9" IN LAST COLUMN. FOR EACH FUNCTION THAT R DISCUSSES, PROBE FOR PRODUCT USED AND RELEVANCE IF PRODUCTS ARE USED.

SUGGESTED PROBES:

"Which of the five products (POINT TO EXHIBIT) are used?"

IF PRODUCTS ARE USED:

"To what extent are these products relevant to (FUNCTION BEING DISCUSSED)"

15. As you look ahead, which of these planning and management functions do you expect to be most important to your institution?

1 Constitutional/Statutory Authority Decisions
2 Strategic Planning
3 Resource Acquisition
4 Resource Allocation
5 Institutional and Management Control
6 Evaluation/Reporting/Analysis
7 Other (Specify) _____

_____

TAKE BACK EXHIBIT C

16. In a few words, please tell me how analytical tools, either computer-based or non-computer based, could help you in these functions.

The next questions are about inhibitors to the use of NCHEMS products.

Once again, will you please circle the number alongside the answer which best represents your opinion.

HAND RESPONDENT QUESTIONNAIRE AND PENCIL.

17a. In your opinion, which of these factors inhibit the use of NCHEMS products in your institution? Circle as many numbers as apply.

1 Use of the products in decision-making tends to replace values (either personal, professional, or institutional)

2 Decision-makers need more training to better use such tools in their work.

3 The use of NCHEMS products for inter-institutional or external decision-making tends to expose proprietary data and weaken your institition's bargaining position with external agencies and publics.

4 The use of NCHEMS products for intra-institutional or internal decision-making modifies the internal balance of power which existed before the products were introduced.

5 The roles of decision-makers and analysts in your institution are not clearly defined and understood.

6 Decision-makers and analysts in your institution do not have compatible expectations about the purposes and results of the NCHEMS products used.

7 Decision-makers and analysts in your institution do not have a compatible orientation toward institutional goals.

8 In your institution there is a conflict between the decision-makers' needs to make timely decisions and the analysts' needs to gather all the relevant data and perform all necessary analyses.

17b. Please write in any other factors that may inhibit the use of NCHEMS products in your institution.

_____

_____

_____

(Please go to next page ....)

18. Please indicate the professional association that you believe is the one most important to you in the development of your managerial philosophy.

1 American Association for Higher Education
2 American Association of Collegiate Registrars and Admissions Officers
3 American Association of Community and Junior Colleges
4 American Association of State Colleges and Universities
5 American Association of University Administrators
6 American Association of University Women
7 American Council on Education
8 American Educational Research Association
9 American Personnel and Guidance Association
10 Association for Institutional Research
11 Association of American Colleges
12 College Entrance Examination Board
13 College Placement Council
14 Council for the Advancement of Small Colleges
15 National Association for Afro-American Education
16 National Association of College Admissions Counselors
17 National Association of Independent Schools
18 National Association of State Universities and Land-Grant Colleges
19 National Association of Student Financial and Administrators
20 National Association of Women Deans and Counselors
21 National Catholic Educational Association
22 National Center for Higher Education Management Systems
23 Council on Post-Secondary Accreditation
24 Office for Advancement of Public Negro Colleges, National Association of State Universities and Land-Grant Colleges
25 Operations Research Society of America/The Institute of Management Science
26 United Negro College Fund
27 Other (Please specify)_____
28 None -- Please skip to Q. 20

19. During the last 10 years, the application of analytical tools such as NCHEMS products has become widely accepted by administrators in American higher education. Many believe that debate and discussions at professional associations have influenced this trend. To what extent do you believe the members of the association you selected above accept the use of analytical tools as an important management concept in performing their professional roles?

4 Great extent
3 Some extent
2 Very little extent
1 No extent
0 No opinion

(Please go to next page ...)

20. These next questions have to do with your opinion about the role the NCHEMS products you have used can play in the broad objective of improving the quality of post-secondary education. Please circle one number on each line.

	GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
a. In your opinion, to what extent can the use of NCHEMS products in your institution contribute toward a better understanding of your college/university as a human community?	4	3	2	1	0
b. To what extent can the use of NCHEMS products and procedures enhance the quality of your college/university as a creative learning environment for students and professors?	4	3	2	1	0
c. To what extent can the use of NCHEMS products result in an improved capacity of your institution to contribute to the needs of society?	4	3	2	1	0

(Please go to next page ....)

21. In our analysis of the NCHEMS products included in this study, we have identified several assumptions which are inherent across all the five products. Please indicate your agreement with these assumptions as they are valid for your institution.

	AGREE STRONGLY	AGREE MILDLY	DISAGREE MILDLY	DISAGREE STRONGLY
a. Post-secondary institution decision-making, management, and planning are generally in need of improvement	4	3	2	1
b. Improvement may be gained through the use of structural frameworks for information gathering and analysis	4	3	2	1
c. Improvement may be gained through better and more consistent information and analysis	4	3	2	1
d. Improvement may be gained by the sharing of consistent information brought about by structural mechanisms such as the NCHEMS products	4	3	2	1
e. More quantitative information leads to better decision-making	4	3	2	1
f. Normative models (i.e., how decision-making, management, and planning ought to be) can be deductively developed and can help institutions in their management activities	4	3	2	1
g. Inductive processes (i.e., empirical data gathering, analysis, and synthesis) can be delayed until a product is field tested	4	3	2	1
h. The emphasis should be on a macro-analytic or central administrative view with regard to the gathering and analyzing of quantitative information	4	3	2	1
i. The focus is on institutional internal information of the present to the exclusion of external effects and uncertainties of the future (e.g., economic, demographic, or student choice shifts)	4	3	2	1
j. Productivity is the central evaluation measure with respect to institutional performance	4	3	2	1

PLEASE RETURN THIS QUESTIONNAIRE TO YOUR INTERVIEWER.

CIRCLE TYPE OF RESPONDENT:

1 INSTITUTIONAL MANAGEMENT
2 ACADEMIC MANAGEMENT → ASK Q. 22 AND TERMINATE INTERVIEW

3 ANALYTIC FUNCTION → GO TO FORM B (REMEMBER TO ASK Q. 22 AT END OF INTERVIEW)

22. Thank you. That concludes the interview. Are there any additional ideas that you would care to mention to help NCHEMS design products to better serve your institution?

RESPONDENT'S TITLE _____

51487
020978
FORM B

FICE CODE

NCHEMS STUDY

ANALYTIC STAFF INTERVIEW

1a. In your institution, is the responsibility for the analytic function assigned to --

1 A person in a management position who also has other management functions;

2 A single person assigned only to the analytic function; or

[3] A staff of more than one?

4 Other (Specify)_____ _____

_____

IF STAFF OF MORE THAN ONE PERSON:

1b. How many professional administrators are in that staff or office?

_____
ENTER NUMBER

2a. Has your institution used any computer-based analytical management tools other than NCHEMS products?

[1] Yes
2 No

IF YES:

2b. Were they developed by the staff of your institution or purchased or acquired from an external service?

1 Developed by staff of institution
2 Purchased or acquired from external service
3 Both

Will you please co ete this next question. (HAND RESPONDENT PENCIL AND QUESTIONNAIRE

3. Please indicate the level of mechanization at your institution, at the present time, for processing the following types of data. Circle one number for each type of data. If more than one level is applicable, circle the one most frequently used.

	MANUAL SYSTEM ONLY	BOOK-KEEPING MACHINE	LEDGER ACCNTG. MACHINE	TABULATION EQUIPMENT	COMPUTER -- BATCH PROCESSING	COMPUTER -- ON-LINE PROCESSING
a. Students (including admissions, testing and counseling, registration, and alumni)	1	2	3	4	5	6
b. Curriculum (such as classes, tutorials, laboratories, off-campus activities)	1	2	3	4	5	6
c. Personnel/Payroll (includes both faculty and staff)	1	2	3	4	5	6
d. Financial (includes purchasing and disbursements, budget, general ledger, income, student accounting, financial aid and billing)	1	2	3	4	5	6
e. Facilities (physical plant, space utilization and equipment)	1	2	3	4	5	6
f. Miscellaneous (bookstore, library cataloguing, circulation, etc.)	1	2	3	4	5	6
g. Other (Please specify) _____ _____	1	2	3	4	5	6

PLEASE RETURN THE QUESTIONNAIRE TO YOUR INTERVIEWER.

4a. INTERVIEWER: REFER BACK TO FORM A, Q. 13, TO DETERMINE WHICH PRODUCTS HAS HEARD OF. CIRCLE BELOW

1 AUPM
2 CADMS
3 IEP
4 PCS
5 RRPM

4b. FOR ALL THOSE PRODUCTS CIRCLED ABOVE WHICH RESPONDENT HAS HEARD OF, ASK:

Please tell me if your institution is presently using the following NCHEMS products.

	USING	NOT USING	DON'T KNOW
1 AUPM	1	2	3
2 CADMS	1	2	3
3 IEP	1	2	3
4 PCS	1	2	3
5 RRPM	1	2	3

4c. IF RRPM IS BEING USED BUT CADMS NOT, ASK:

SHOW EXHIBIT D

For both the student and the faculty input data required by RRPM, how was it prepared by the institution? First, the student input data, was it ... (READ CHOICES, THEN REPEAT FOR FACULTY INPUT DATA.)

	STUDENT	FACULTY
1. prepared manually	1	1
2. prepared by using an earlier version of ICLM software for student/ curriculum data	2	2
3. an institutionally developed interface between operational data and RRPM input requirements	3	3
4. Other (Specify) _____ _____	4	4

TAKE BACK EXHIBIT D

INTERVIEWER: FOR THOSE PRODUCTS INSTITUTION IS NOT USING BUT RESPONDENT HAS HEARD OF (SEE 4a-4b) ASK QUESTIONS 4d-14.

4d. Have you ever evaluated (PRODUCT) for use in your institution?

	AUPM	CADMS	IEP	PCS	RRPM
Yes	1	1	1	1	1
No	2	2	2	2	2
Don't know -- REFER TO LAST PAGE INSTRUCTION	3	3	3	3	3

IF "YES" ON Q. 4d, CONTINUE.
IF "NO," GO TO Q. 4d NEXT PRODUCT HEARD OF AND NOT NOW USING.

SHOW EXHIBIT E-1	1 AUPM	2 CADMS	3 IEP	4 PCS	5 RRPM
5. As a result of the evaluation, did you decide to give the product a trial -- as offered, with modifications -- or did you reject the idea of trying it?					
Tried as offered (or with updates from NCHEMS)	1	1	1	1	1
Tried with institutional modifications	2	2	2	2	2
Rejected	3	3	3	3	3

SHOW EXHIBIT F

6. Here's a list of product characteristics that you would consider in making your decision. Please select the three most important characteristics in their effect on your decision to try or not try the product.					
Initial cost	1	1	1	1	1
Maintenance cost	2	2	2	2	2
Flexibility	3	3	3	3	3
Availability of NCHEMS staff for technical assistance	4	4	4	4	4
Sophistication of algorithms	5	5	5	5	5
Other (Specify)_____	6	6	6	6	6

IF PRODUCT TRIED ON Q. 5 (AS OFFERED, OR WITH MODIFICATIONS), CONTINUE. IF "REJECTED," GO BACK TO Q. 4d FOR NEXT PRODUCT HEARD OF AND NOT NOW USING.

SHOW EXHIBIT E-1 AGAIN

7. After trying the product, did you decide to adopt its use -- as offered, with modifications -- or did you reject the idea of adopting the product?					
Adopt as offered (or with updates from NCHEMS)	1	1	1	1	1
Adopt with institutional modifications	2	2	2	2	2
Rejected	3	3	3	3	3

	1 AUPM	2 CADMS	3 IEP	4 PCS	5 RRPM
SHOW EXHIBIT F AGAIN					
8. Again, please tell me the three most important characteristics in their effect on your decision.					
Initial cost	1	1	1	1	1
Maintenance cost	2	2	2	2	2
Flexibility	3	3	3	3	3
Availability of NCHEMS staff for technical assistance	4	4	4	4	4
Sophistication of algorithms	5	5	5	5	5
Other (Specify)_____	6	6	6	6	6
TAKE BACK EXHIBIT F					
IF PRODUCT ADOPTED ON Q. 7, CONTINUE. IF "REJECTED," GO BACK TO Q. 4b FOR NEXT PRODUCT HEARD OF AND NOT NOW USING.					
9. When you chose (PRODUCT), did you first consider developing your own model or approach rather than choosing the NCHEMS product?					
Yes	1	1	1	1	1
No	2	2	2	2	2
IF YES ON Q. 9, ASK:					
SHOW EXHIBIT G					
10. Which of these questions did you consider?					
Staff qualifications	1	1	1	1	1
What to do with staff when modeling done	2	2	2	2	2
How long to complete	3	3	3	3	3
Cost	4	4	4	4	4
Other (Specify)_____	5	5	5	5	5
TAKE BACK EXHIBIT G					

		1 AUPM	2 CADMS	3 IEP	4 PCS	5 RRPM
11.	When did your college/university first start using (PRODUCT)? PROBE FOR BEST ESTIMATE.					
	1970	0	0	0	0	0
	'71	1	1	1	1	1
	'72	2	2	2	2	2
	'73	3	3	3	3	3
	'74	4	4	4	4	4
	'75	5	5	5	5	5
	'76	6	6	6	6	6
	'77	7	7	7	7	7
	'78	8	8	8	8	8
	Don't know	9	9	9	9	9
12.	Did you use (PRODUCT) as originally received, or in a modified form?					
	Yes, as originally received (or updated by NCHEMS)	1	1	1	1	1
	Yes, in form modified by institution	2	2	2	2	2
13.	When did you stop using (PRODUCT)?					
	1970	0	0	0	0	0
	'71	1	1	1	1	1
	'72	2	2	2	2	2
	'73	3	3	3	3	3
	'74	4	4	4	4	4
	'75	5	5	5	5	5
	'76	6	6	6	6	6
	'77	7	7	7	7	7
	'78	8	8	8	8	8
	Don't know	9	9	9	9	9

SHOW EXHIBIT H

14. Here are some reasons why a product's use may have been discontinued. Please tell me the number of each reason that applies to your discontinuing the use of (PRODUCT).

	AUPM	CADMS	IEP	PCS	RRPM
a. The product (model) was superseded by an improved version	1	1	1	1	1
b. The product was modified to more appropriately meet our objective	2	2	2	2	2
c. The task for which the product was designed was completed	3	3	3	3	3
d. Inadequate money budget to continue project	4	4	4	4	4
e. Inadequate technical development	5	5	5	5	5
f. Lack of trained internal staff	6	6	6	6	6
g. Insufficient commitment of institutional management time	7	7	7	7	7
h. Insufficient commitment of academic administrators	8	8	8	8	8
i. Lack of necessary internal data	9	9	9	9	9
j. Difficulties in use of the product	10	10	10	10	10
k. Inadequate computer facilities	11	11	11	11	11
l. Product insufficiently flexible to meet management's needs	12	12	12	12	12
m. Decision-makers could not understand output	13	13	13	13	13
n. Product only told us what we already knew	14	14	14	14	14
o. Output took too much time; data untimely	15	15	15	15	15
p. Results too quantitative, ignore qualitative aspects	16	16	16	16	16
q. Provided more information than we needed	17	17	17	17	17
r. Incurred cost exceeded realized benefits	18	18	18	18	18
s. Person who advocated use of product left or was promoted	19	19	19	19	19
t. Other (Specify)_____	20	20	20	20	20

TAKE BACK EXHIBIT H

ASK THIS SERIES FOR THOSE PRODUCTS RESPONDENT IS NOW USING:

15a. INTERVIEWER: REFER BACK TO Q. 4b. CIRCLE EACH PRODUCT RESPONDENT IS USING →	1 AUPM	2 CADMS	3 IEP	4 PCS	5 RRPM

SHOW EXHIBIT E-2

15b. Thinking back to the time when you first evaluated (PRODUCT), did you decide to try the product as offered, or did you make modifications before trial?

Tried as offered (or with updates from NCHEMS)	1	1	1	1	1
Tried with institutional modifications	2	2	2	2	2

SHOW EXHIBIT F

16. Here's a list of product characteristics that you may have considered in making your decision. Please select the three most important characteristics in their effect on your decision to try the product.

Initial cost	1	1	1	1	1
Maintenance cost	2	2	2	2	2
Flexibility	3	3	3	3	3
Availability of NCHEMS staff for technical assistance	4	4	4	4	4
Sophistication of algorithms	5	5	5	5	5
Other (Specify)_____	6	6	6	6	6

SHOW EXHIBIT E-2 AGAIN

17. After trying the product, did you decide to adopt its use as offered, or adopt it with modifications?

Adopt as offered (or with updates from NCHEMS)	1	1	1	1	1
Adopt with institutional modifications	2	2	2	2	2

	1 AUPM	2 CADMS	3 IEP	4 PCS	5 RRPM
SHOW EXHIBIT F AGAIN					
18. Please tell me the three most important characteristics in their effect on your decision to adopt (PRODUCT).					
Initial cost	1	1	1	1	1
Maintenance cost	2	2	2	2	2
Flexibility	3	3	3	3	3
Availability of NCHEMS staff for technical assistance	4	4	4	4	4
Sophistication of algorithms	5	5	5	5	5
Other (Specify)_____	6	6	6	6	6
TAKE BACK EXHIBIT F					
19. When you chose (PRODUCT), did you first consider developing your own model or approach rather than choosing the NCHEMS product?					
Yes	1	1	1	1	1
No	2	2	2	2	2
IF YES ON Q.19, ASK:					
SHOW EXHIBIT G					
20. Which of these questions did you consider?					
Staff qualifications	1	1	1	1	1
What to do with staff when modeling done	2	2	2	2	2
How long to complete	3	3	3	3	3
Cost	4	4	4	4	4
Other (Specify)_____	5	5	5	5	5
TAKE BACK EXHIBIT G					

FICE CODE

51487
020978
FORM C

AUPM

(Academic Unit Planning and Management)

Please circle one number on each line.	TO A GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
1a. In your opinion, to what extent is AUPM being used in the identification and organization of data about academic unit functions within the context of your institution?	4	3	2	1	0
b. To what extent does it help in the allocation of human resources?	4	3	2	1	0
c. To what extent does it help in the allocation of physical resources?	4	3	2	1	0
d. To what extent is AUPM being used to identify the sources and uses of funds?	4	3	2	1	0
e. To what extent does it help in the planning and assessment of academic unit outcomes?	4	3	2	1	0
f. To what extent does AUPM provide assessment for qualitative as well as quantitative information?	4	3	2	1	0
g. To what extent has AUPM assisted in including faculty in academic planning?	4	3	2	1	0
h. To what extent are there systematic institutional planning processes to support your use of AUPM?	4	3	2	1	0

2. To the best of your knowledge, which of these groups use AUPM in their job responsibilities? Please circle as many as apply.

1 Institutional Management (people with institution-wide decision-making responsibilities, such as the President, Chief Academic Officer, Chief Fiscal Officer)

2 Academic Management (people below the Chief Academic Officer, such as Academic Deans, other than the Chief Academic Officer, Department Heads, Faculty Representatives)

3 Analytic Staff (those responsible for providing staff support for planning and data processing, such as Planning Officer, Institutional Research Director, Director of Computer Services)

3a. Which of the following are your institution's reasons for using AUPM? Please circle as many as apply.

1 Requirement for more useful day-to-day institutional management

2 Internal requirement

3 External funding/governance requirement (consider central or system office to be external)

4 Need for forecasting ability (consideration of alternatives)

5 Need for analysis of historical trends

6 Need for integration of institutional data

7 Better data required to react to external queries

8 Better data required to allocate increasingly scarce resources

9 Pilot project experiment (not intended for use in costing or planning activities)

10 Improve design of information system to meet needs of decision-makers

11 Facilitate adoption of program budgeting (rational budgeting)

12 No stated or intended objectives

13 Other (Please specify) _____

3b. If you circled item 3 above (external funding/governance requirement), please indicate which agencies require it. Please circle as many as apply.

1 Central office of multi-branch institution

2 Systems office of multi-campus system

3 Statewide coordinating governing board

4 Other executive office of state government

5 Legislative branch of state government

6 Requirement/part of a grant or contract from a federal agency

7 Requirement/part of a grant or contract from a private source or sources (foundation, corporation, etc.)

8 Other (Please specify) _____

4. How is AUPM used in your institution? Please circle as many as apply.

1 To make decisions
2 To prepare internal reports
3 To prepare reports for external agencies
4 For staff analysis
5 To define problems and generate alternatives
6 To analyze alternatives and test assumptions
7 To validate own thoughts, intuition, and wisdom
8 To perform analysis required of your job responsibilities
9 To help internal communications
10 To help inter-institutional communications
11 To ease accountability pressures
12 As a transition from qualitative-based to quantitative-based management
13 To develop data bases of the institution
14 To develop questions about institutional operations
15 Other (Please specify)_____

5. What benefits are realized from using AUPM? Please circle as many as apply.

1 Costing savings
2 More timely decision-making
3 Better quality decision-making
4 More confident decision-making
5 Increase acceptance, within the institution, of the results of decision-making
6 Increase acceptance by people outside the institution of the results
7 Better understanding of our institution's activities
8 Permits sensitivity analysis
9 Permits exploration of more alternatives than previously
10 Improve design of information system (data base)
11 Facilitate adoption of program budgeting
12 Understand concepts represented by products, not just the products themselves
13 Serves as an avenue for the development and implementation of more appropriate models/tools
14 Satisfy curiosity about the use of planning and management tools
15 Demonstrate good management practice
16 Facilitate reporting to external agencies (including your central or system office)
17 Other (Please specify) _____

FICE CODE

51487
020978
FORM D

CADMS

(Costing and Data Management System)

Please circle one number on each line.	TO A GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
1a. To what extent does CADMS assist your institution in the implementation of cost studies?	4	3	2	1	0
b. To what extent is it used for studies of current cost?	4	3	2	1	0
c. To what extent is it used for historical cost studies?	4	3	2	1	0
d. To what extent do you consider CADMS output to be a reliable simulator of student course selection behavior?	4	3	2	1	0
e. To what extent does CADMS support, or is it consistent with, your use of other NCHEMS products?	4	3	2	1	0
f. To what extent is the assumption that faculty activities can be analyzed or distributed consistent with contractual teaching and release-time obligations?	4	3	2	1	0

2. To the best of your knowledge, which of these groups use CADMS in their job responsibilities? Please circle as many as apply.

1 Institutional Management (people with institution-wide decision-making responsibilities, such as the President, Chief Academic Officer, Chief Fiscal Officer)

2 Academic Management (people below the Chief Academic Officer, such as Academic Deans, other than the Chief Academic Officer, Department Heads, Faculty Representatives)

3 Analytic Staff (those responsible for providing staff support for planning and data processing, such as Planning Officer, Institutional Research Director, Director of Computer Services)

3a. Which of the following are your institution's reasons for using CADMS? Please circle as many as apply.

1 Requirement for more useful day-to-day institutional management

2 Internal requirement

3 External funding/governance requirement (consider central or system office to be external)

4 Need for forecasting ability (consideration of alternatives)

5 Need for analysis of historical trends

6 Need for integration of institutional data

7 Better data required to react to external queries

8 Better data required to allocate increasingly scarce resources

9 Pilot project experiment (not intended for use in costing or planning activities)

10 Improve design of information system to meet needs of decision-makers

11 Facilitate adoption of program budgeting (rational budgeting)

12 No stated or intended objectives

13 Other (Please specify) _____

3b. If you circled item 3 above (external funding/governance requirement), please indicate which agencies require it. Please circle as many as apply.

1 Central office of multi-branch institution

2 Systems office of multi-campus system

3 Statewide coordinating governing board

4 Other executive office of state government

5 Legislative branch of state government

6 Requirement/part of a grant or contract from a federal agency

7 Requirement/part of a grant or contract from a private source or sources (foundation, corporation, etc.)

8 Other (Please specify) _____

4. How is CADMS used in your institution? Please circle as many as apply.

1 To make decisions
2 To prepare internal reports
3 To prepare reports for external agencies
4 For staff analysis
5 To define problems and generate alternatives
6 To analyze alternatives and test assumptions
7 To validate own thoughts, intuition, and wisdom
8 To perform analysis required of your job responsibilities
9 To help internal communications
10 To help inter-institutional communications
11 To ease accountability pressures
12 As a transition from qualitative-based to quantitative-based management
13 To develop data bases of the institution
14 To develop questions about institutional operations
15 Other (Please specify)_____

5. What benefits are realized from using CADMS? Please circle as many as apply.

1 Costing savings
2 More timely decision-making
3 Better quality decision-making
4 More confident decision-making
5 Increase acceptance, within the institution, of the results of decision-making
6 Increase acceptance by people outside the institution of the results
7 Better understanding of our institution's activities
8 Permits sensitivity analysis
9 Permits exploration of more alternatives than previously
10 Improve design of information system (data base)
11 Facilitate adoption of program budgeting
12 Understand concepts represented by products, not just the products themselves
13 Serves as an avenue for the development and implementation of more appropriate models/tools
14 Satisfy curiosity about the use of planning and management tools
15 Demonstrate good management practice
16 Facilitate reporting to external agencies (including your central or system office)
17 Other (Please specify) _____

FICE CODE

51487
020978
FORM E

IEP

(Information Exchange Procedures)

Please circle one number on each line.	TO A GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
1. To what extent is IEP being used for collecting, reorganizing, and displaying . . .					
a. general descriptive and supporting longitudinal institutional data (across time)?	4	3	2	1	0
b. general descriptive and supporting data of a cross-sectional nature (for a group of institutions)?	4	3	2	1	0
c. direct costs for all IEP Activity Centers?	4	3	2	1	0
d. direct costs by unit of instruction?	4	3	2	1	0
e. full costs for IEP-defined "final cost objectives"?	4	3	2	1	0
f. full costs by unit of instruction?	4	3	2	1	0
g. outcomes of student programs?	4	3	2	1	0
h. To what extent is IEP data from your institution being used by funding agencies?	4	3	2	1	0
To what extent do you find the following IEP outputs valuable in your institution . . .					
i. longitudinal institutional data (across time)?	4	3	2	1	0
j. cross-sectional data (for a group of institutions)?	4	3	2	1	0
k. direct costs for all IEP Activity Centers?	4	3	2	1	0
L. direct costs by unit of instruction?	4	3	2	1	0
m. full costs for IEP-defined "final cost objectives"?	4	3	2	1	0
n. full costs by unit of instruction?	4	3	2	1	0
o. outcomes of student programs?	4	3	2	1	0

	TO A GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
To what extent is IEP being used in your insitution . . .					
p. for institutional comparative analysis, particularly in the resource allocation context?	4	3	2	1	0
q. to improve the quantity and quality of data that the institution brings to bear on their internal planning and management?	4	3	2	1	0
r. to assist the institution in discharging their various reporting responsibilities?	4	3	2	1	0

2. To the best of your knowledge, which of these groups use IEP in their job responsibilities? Please circle as many as apply.

   1 Institutional Management (people with institution-wide decision-making responsibilities, such as the President, Chief Academic Officer, Chief Fiscal Officer)

   2 Academic Management (people below the Chief Academic Officer, such as Academic Deans, other than the Chief Academic Officer, Department Heads, Faculty Representatives)

   3 Analytic Staff (those responsible for providing staff support for planning and data processing, such as Planning Officer, Institutional Research Director, Director of Computer Services)

3a. Which of the following are your institution's reasons for using IEP? Please circle as many as apply.

1 Requirement for more useful day-to-day institutional management

2 Internal requirement

3 External funding/governance requirement (consider central or system office to be external)

4 Need for forecasting ability (consideration of alternatives)

5 Need for analysis of historical trends

6 Need for integration of institutional data

7 Better data required to react to external queries

8 Better data required to allocate increasingly scarce resources

9 Pilot project experiment (not intended for use in costing or planning activities)

10 Improve design of information system to meet needs of decision-makers

11 Facilitate adoption of program budgeting (rational budgeting)

12 No stated or intended objectives

13 Other (Please specify) _____

3b. If you circled item 3 above (external funding/governance requirement), please indicate which agencies require it. Please circle as many as apply.

1 Central office of multi-branch institution

2 Systems office of multi-campus system

3 Statewide coordinating governing board

4 Other executive office of state government

5 Legislative branch of state government

6 Requirement/part of a grant or contract from a federal agency

7 Requirement/part of a grant or contract from a private source or sources (foundation, corporation, etc.)

8 Other (Please specify) _____

4. How is IEP used in your institution? Please circle as many as apply.

1 To make decisions
2 To prepare internal reports
3 To prepare reports for external agencies
4 For staff analysis
5 To define problems and generate alternatives
6 To analyze alternatives and test assumptions
7 To validate own thoughts, intuition, and wisdom
8 To perform analysis required of your job responsibilities
9 To help internal communications
10 To help inter-institutional communications
11 To ease accountability pressures
12 As a transition from qualitative-based to quantitative-based management
13 To develop data bases of the institution
14 To develop questions about institutional operations
15 Other (Please specify)_____

5. What benefits are realized from using IEP?
Please circle as many as apply.

1 Costing savings
2 More timely decision-making
3 Better quality decision-making
4 More confident decision-making
5 Increase acceptance, within the institution, of the results of decision-making
6 Increase acceptance by people outside the institution of the results
7 Better understanding of our institution's activities
8 Permits sensitivity analysis
9 Permits exploration of more alternatives than previously
10 Improve design of information system (data base)
11 Facilitate adoption of program budgeting
12 Understand concepts represented by products, not just the products themselves
13 Serves as an avenue for the development and implementation of more appropriate models/tools
14 Satisfy curiosity about the use of planning and management tools
15 Demonstrate good management practice
16 Facilitate reporting to external agencies (including your central or system office)
17 Other (Please specify) _____

FICE CODE

51487
020978
FORM F

PCS

(Program Classification Structure)

Please circle one number on each line.	TO A GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
1a. To what extent do the PCS categories describe your organizational functions and activities?	4	3	2	1	0
To what extent is PCS used in external reporting requirements . . .					
b. HEGIS?	4	3	2	1	0
c. financial audit reports?	4	3	2	1	0
d. state-level reporting?	4	3	2	1	0
e. other external reporting?	4	3	2	1	0
f. To what extent is PCS used internally to relate programs and activities to the objectives of the institution?	4	3	2	1	0
g. To what extent are the functions described by PCS comparable to the functions of your institution?	4	3	2	1	0
h. To what extent does PCS facilitate the integration of institutional data into program (as opposed to organizational) formats?	4	3	2	1	0
i. To what extent does PCS relate to your organizational units?	4	3	2	1	0
j. To what extent does your institution use PCS as a communication tool or format (for example, in discussions of resource allocations, for comparative analysis of institutional programs, or comparative analysis with similar programs in other institutions)?	4	3	2	1	0
k. To what extent does PCS focus on institutional functions and objectives rather than on administrative units?	4	3	2	1	0

2. To the best of your knowledge, which of these groups use PCS in their job responsibilities? Please circle as many as apply.

1 Institutional Management (people with institution-wide decision-making responsibilities, such as the President, Chief Academic Officer, Chief Fiscal Officer)

2 Academic Management (people below the Chief Academic Officer, such as Academic Deans, other than the Chief Academic Officer, Department Heads, Faculty Representatives)

3 Analytic Staff (those responsible for providing staff support for planning and data processing, such as Planning Officer, Institutional Research Director, Director of Computer Services)

3a. Which of the following are your institution's reasons for using PCS? Please circle as many as apply.

1 Requirement for more useful day-to-day institutional management

2 Internal requirement

3 External funding/governance requirement (consider central or system office to be external)

4 Need for forecasting ability (consideration of alternatives)

5 Need for analysis of historical trends

6 Need for integration of institutional data

7 Better data required to react to external queries

8 Better data required to allocate increasingly scarce resources

9 Pilot project experiment (not intended for use in costing or planning activities)

10 Improve design of information system to meet needs of decision-makers

11 Facilitate adoption of program budgeting (rational budgeting)

12 No stated or intended objectives

13 Other (Please specify) _____

3b. If you circled item 3 above (external funding/governance requirement), please indicate which agencies require it. Please circle as many as apply.

1 Central office of multi-branch institution

2 Systems office of multi-campus system

3 Statewide coordinating governing board

4 Other executive office of state government

5 Legislative branch of state government

6 Requirement/part of a grant or contract from a federal agency

7 Requirement/part of a grant or contract from a private source or sources (foundation, corporation, etc.)

8 Other (Please specify) _____

4. How is PCS used in your institution? Please circle as many as apply.

1 To make decisions
2 To prepare internal reports
3 To prepare reports for external agencies
4 For staff analysis
5 To define problems and generate alternatives
6 To analyze alternatives and test assumptions
7 To validate own thoughts, intuition, and wisdom
8 To perform analysis required of your job responsibilities
9 To help internal communications
10 To help inter-institutional communications
11 To ease accountability pressures
12 As a transition from qualitative-based to quantitative-based management
13 To develop data bases of the institution
14 To develop questions about institutional operations
15 Other (Please specify)_____

5. What benefits are realized from using PCS?
Please circle as many as apply.

1 Costing savings
2 More timely decision-making
3 Better quality decision-making
4 More confident decision-making
5 Increase acceptance, within the institution, of the results of decision-making
6 Increase acceptance by people outside the institution of the results
7 Better understanding of our institution's activities
8 Permits sensitivity analysis
9 Permits exploration of more alternatives than previously
10 Improve design of information system (data base)
11 Facilitate adoption of program budgeting
12 Understand concepts represented by products, not just the products themselves
13 Serves as an avenue for the development and implementation of more appropriate models/tools
14 Satisfy curiosity about the use of planning and management tools
15 Demonstrate good management practice
16 Facilitate reporting to external agencies (including your central or system office)
17 Other (Please specify) _____

FICE CODE

51487
020978
FORM G

RRPM

(Resource Requirement Prediction Model)

Please circle one number on each line.	TO A GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
1a. To what extent is RRPM used to test alternative strategies in your institution for making future cost projections?	4	3	2	1	0
b. . . . for historical cost analysis?	4	3	2	1	0
c. . . . for current cost analysis?	4	3	2	1	0
d. To what extent is it used by organizational units for line-item budget data?	4	3	2	1	0
e. To what extent is it used for program budget reports indicating discipline or department contributions to instructional programs?	4	3	2	1	0
f. To what extent is RRPM used for current cost analysis?	4	3	2	1	0
g. To what extent does the assumption of accumulated academic credit units permit you to simulate your educational process or philosophy?	4	3	2	1	0
h. To what extent are average cost analyses appropriate for your purposes?	4	3	2	1	0
i. To what extent would marginal cost analyses be appropriate for your purposes?	4	3	2	1	0
j. To what extent would fixed variable cost analyses be appropriate for your purposes?	4	3	2	1	0
k. To what extent is it appropriate to simulate your institution in terms of the instructive function as opposed to the research or public service function?	4	3	2	1	0

		TO A GREAT EXTENT	SOME EXTENT	VERY LITTLE	NO EXTENT	NO OPINION
1L.	To what extent can you approximate actual faculty commitment to your institution based on contractual time commitments?	4	3	2	1	0
m.	To what extent are deterministic (single-value) projections appropriate for your purposes?	4	3	2	1	0
n.	Based on historical enrollment patterns, to what extent can student demand for instruction be approximated, utilizing the Induced Course Load Matrix concept?	4	3	2	1	0
o.	To what extent can the factors represented by the key variables of RRPM be affected by the management of your institution?	4	3	2	1	0

2. To the best of your knowledge, which of these groups use RRPM in their job responsibilities? Please circle as many as apply.

1 Institutional Management (people with institution-wide decision-making responsibilities, such as the President, Chief Academic Officer, Chief Fiscal Officer)

2 Academic Management (people below the Chief Academic Officer, such as Academic Deans, other than the Chief Academic Officer, Department Heads, Faculty Representatives)

3 Analytic Staff (those responsible for providing staff support for planning and data processing, such as Planning Officer, Institutional Research Director, Director of Computer Services)

3a. Which of the following are your institution's reasons for using RRPM? Please circle as many as apply.

1 Requirement for more useful day-to-day institutional management

2 Internal requirement

3 External funding/governance requirement (consider central or system office to be external)

4 Need for forecasting ability (consideration of alternatives)

5 Need for analysis of historical trends

6 Need for integration of institutional data

7 Better data required to react to external queries

8 Better data required to allocate increasingly scarce resources

9 Pilot project experiment (not intended for use in costing or planning activities)

10 Improve design of information system to meet needs of decision-makers

11 Facilitate adoption of program budgeting (rational budgeting)

12 No stated or intended objectives

13 Other (Please specify) _____

3b. If you circled item 3 above (external funding/governance requirement), please indicate which agencies require it. Please circle as many as apply.

1 Central office of multi-branch institution

2 Systems office of multi-campus system

3 Statewide coordinating governing board

4 Other executive office of state government

5 Legislative branch of state government

6 Requirement/part of a grant or contract from a federal agency

7 Requirement/part of a grant or contract from a private source or sources (foundation, corporation, etc.)

8 Other (Please specify) _____

4. How is RRPM used in your institution? Please circle as many as apply.

1 To make decisions
2 To prepare internal reports
3 To prepare reports for external agencies
4 For staff analysis
5 To define problems and generate alternatives
6 To analyze alternatives and test assumptions
7 To validate own thoughts, intuition, and wisdom
8 To perform analysis required of your job responsibilities
9 To help internal communications
10 To help inter-institutional communications
11 To ease accountability pressures
12 As a transition from qualitative-based to quantitative-based management
13 To develop data bases of the institution
14 To develop questions about institutional operations
15 Other (Please specify) _____

5. What benefits are realized from using RRPM? Please circle as many as apply.

1 Costing savings
2 More timely decision-making
3 Better quality decision-making
4 More confident decision-making
5 Increase acceptance, within the institution, of the results of decision-making
6 Increase acceptance by people outside the institution of the results
7 Better understanding of our institution's activities
8 Permits sensitivity analysis
9 Permits exploration of more alternatives than previously
10 Improve design of information system (data base)
11 Facilitate adoption of program budgeting
12 Understand concepts represented by products, not just the products themselves
13 Serves as an avenue for the development and implementation of more appropriate models/tools
14 Satisfy curiosity about the use of planning and management tools
15 Demonstrate good management practice
16 Facilitate reporting to external agencies (including your central or system office)
17 Other (Please specify) _____

EXHIBIT A

- Know the product very well
- Fairly well
- Heard of, know only a little about it
- Never heard of it

NCHEMS PRODUCTS:

1. AUPM (Academic Unit Planning and Management)
2. CADMS (Costing and Data Management System)
3. IEP (Information Exchange Procedures)
4. PCS (Program Classification Structure)
5. RRPM (Resource Requirement Prediction Model)

EXHIBIT B

- To a great extent
- To some extent
- To very little extent
- To no extent

SOURCES OF INFORMATION:

A. Formal papers and presentations by NCHEMS staff and/or members of advisory structures representing NCHEMS.

B. Published proceedings of meetings, seminars, and assemblies.

C. User-oriented (overview) NCHEMS manuals about the products.

D. Technical NCHEMS manuals about the products.

E. Case study documentation on results/benefits/ problems in using NCHEMS products

F. NCHEMS training and dissemination seminars.

G. Referrals from others who have used the products.

H. Other sources (please specify)

EXHIBIT C

PLANNING AND MANAGEMENT FUNCTIONS:

A. Constitutional/Statutory Authority Decisions
   -- Includes establishing the corporate authority of an educational institution such as a charter, legislation, or administrative code; authorizing degree granting authority; and the allocation of differentiated authority and responsibility for the governance and management of the institution.

B. Strategic Planning

C. Resource Acquisition

D. Resource Allocation

E. Institutional and Management Control

F. Evaluation/Reporting/Analysis

G. Other (Please specify)

NCHEMS PRODUCTS:

AUPM (Academic Unit Planning and Management)

CADMS (Costing and Data Management System)

IEP (Information Exchange Procedures)

PCS (Program Classification Structure)

RRPM (Resource Requirement Prediction Model)

RELEVANCE:

Relevant to a great extent

To some extent

To very little extent

To no extent

EXHIBIT D

1. Prepared manually

2. Prepared by using an earlier version of ICLM software for student/ curriculum data

3. An institutionally developed interface between operational data and RRPM input requirements

EXHIBIT E-1

1. As offered (or with updates from NCHEMS)

2. With institutional modifications

3. Rejected

EXHIBIT E-2

1. As offered (or with updates from NCHEMS)

2. With institutional modifications

EXHIBIT F

1. Initial cost

2. Maintenance cost

3. Flexibility

4. Availability of NCHEMS staff for technical assistance

5. Sophistication of algorithms

EXHIBIT G

1. Staff qualifications required -- the ability of your internal staff to develop the model

2. If you hired the necessary staff, what they would do when the modeling job was done

3. How long a time it would take to complete the model

4. How much it would cost

EXHIBIT H

1. The product (model) was superseded by an improved version
2. The product was modified to more appropriately meet our objective
3. The task for which the product was designed was completed
4. Inadequate money budget to continue project
5. Inadequate technical development
6. Lack of trained internal staff
7. Insufficient commitment of institutional management time
8. Insufficient commitment of academic administrators
9. Lack of necessary internal data
10. Difficulties in use of the product
11. Inadequate computer facilities
12. Product insufficiently flexible to meet management's needs
13. Decision-makers could not understand output
14. Product only told us what we already knew
15. Output took too much time; data untimely
16. Results too quantitative, ignore qualitative aspects
17. Provided more information than we needed
18. Incurred cost exceeded realized benefits
19. Person who advocated use of product left or was promoted
20. Other (please specify)

APPENDIX E

PHASE II SURVEY

NATIONAL CENTER FOR HIGHER EDUCATION MANAGEMENT SYSTEMS

Size of Sample/Subsample in Which Survey Percentage is Based	Approximate Sampling Tolerances for Survey Percentages At or Near These Levels (%)		
	10% or 90%	30% or 70%	50%
440	4	5	6
300	4	6	7
200	5	8	9
100	7	11	12
50	10	16	17

Number of Cases in Subsamples Compared	Approximate Sampling Tolerances for Differences Between Two Survey Percentages At or Near These Levels (%)		
	10% or 90%	30% or 70%	50%
400 and 300	6	9	9
200	6	10	11
100	8	13	14
50	11	17	18
300 and 200	7	10	11
100	8	13	14
50	11	17	19
200 and 100	9	14	15
50	12	18	19
100 and 50	13	19	21
50 and 50	15	22	25

Calculated with an estimated design effect of 1.25